ORTHODONTIC ANTERIOR TRACTION APPLIANCE

FIG. 8

FIG. 9

FIG. 10

FIG. 11

FIG. 12

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This invention relates to new and useful improvements in orthodontic anterior traction appliances.

The art of orthodontics has developed force systems that are capable of moving teeth in virtually any direction and most of these systems have been perfected to a degree acceptable to both patients and orthodontists. As yet, however, an acceptable system of moving teeth forward by extra-oral anchorage has not been developed. Anterior traction appliances now in use are bulky, uncomfortable and difficult to install. Also, patient cooperation is usually sparse due to the poor esthetic qualities of the appliances. As a result, compromise treatments have been utilized in most instances when anterior movement of teeth is desirable.

Accordingly, the primary object of this invention is to provide an orthodontic traction or anterior traction appliance of simple construction which is easy to install, comfortable and esthetically acceptable. The novel appliance includes a chin cup or support having a pair of upright arms of short length standing therefrom and a pair of elongate arms extending substantially horizontally and having rigid operative connection with the chin cup. The appliance may be installed in either of two ways, in either of which, its stability is dependent upon fixing the inner or rear ends of the substantially horizontal arms against downward movement with the upright arms being connected to the teeth by rubber bands or other suitable elastic means in the conventional manner. One adaption is to support the ends of the substantially horizontal arms outside the mouth from the top of the head by means of a lace, ribbon or other pliable head strap which may be adjustable. In the other method, the substantially horizontal arms are secured to the upper ends of the upright arms so as to form continuations thereof which extend rearwardly into the mouth with their rear ends being suspended from an arch wire mounted on the lower teeth of the patient or otherwise having connection with said teeth. The horizontal and vertical forces of the arms coact to produce a resultant vector of force, the direction of which through the chin maintains the chin cup in place. With either method of installation, the patient may move his mandible or head in any direction outside the arms of the appliance impinging on the soft tissues.

A construction designed to carry out the invention will be hereinafter described, together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings wherein examples of the invention are shown and wherein:

FIG. 1 is a front, perspective view of an orthodontic anterior traction appliance constructed in accordance with the invention and mounted on a patient.

FIG. 2 is a rear, perspective view of the orthodontic anterior traction appliance with the bending thereof being shown in broken lines.

FIG. 3 is an enlarged, elevational view of the appliance mounted on a patient.

FIG. 4 is an enlarged, transverse, vertical sectional view of the patient-mounted appliance.

FIG. 5 is an enlarged, perspective view of the outer end portion of one of the horizontal arms of the appliance.

FIG. 6 is an enlarged, perspective view of the outer end portion of one of the upright arms of the appliance and its notch for receiving a rubber band, shown in broken lines.

FIG. 7 is an approximate vector diagram of the forces utilized in mounting the appliance.

FIG. 8 is a front, perspective view of a modified orthodontic protraction appliance mounted on a patient.

FIG. 9 is a rear, perspective view of the modified appliance.

FIG. 10 is an enlarged, transverse, vertical, sectional view showing the mounting of the modified appliance.

FIG. 11 is a top plan view of the mounted modified appliance, the jaw line being shown in broken lines.

FIG. 12 is an enlarged, perspective view of the hooked rear end portion of one of the horizontal arms of the modified appliance, a portion of a cooperating arch wire being shown in broken lines.

FIG. 13 is an enlarged, perspective view, partly in section, of the joint between one of the upright arms and one of the substantially horizontal arms of the modified appliance, and

FIG. 14 is an approximate vector diagram of the forces utilized in mounting the modified appliance.

In the drawings, the numeral 10 designates an orthodontic protraction or anterior traction appliance embodying the principles of the invention and having a concavo-convex chin support or cup 11 which is adapted to engage the chin C of the patient or wearer of the appliance. The chin cup 11 is of a configuration which conforms generally to the contour of the chin, being formed of plastic, metal or other suitable material, may be of various sizes and may be transparent (FIGS. 1 and 2) or opaque (FIG. 3). As best shown in FIGS. 2 and 4, the cup is substantially angular in cross-section and has a substantially flat, horizontal flange or portion 12 for underlining the chin C and a substantially flat, upright flange or portion 13 upstanding from the horizontal portion so as to overlie the front of said chin. Opposed, curved end flanges or portions 14 connect the lateral margins of the horizontal and upright portions 12 and 13 of the cup 11. As shown by the numeral 15, the perimeter of the chin cup may be rounded and/or flared slightly outward so as to be more comfortable to the wearer. Also, the juncture 16 between the horizontal and upright portions of the cup 11 is arcuate (FIG. 4) so as to eliminate a sharp line of demarcation therebetween.

A pair of divergent, substantially horizontal arms or members 17 project rearwardly from and in the plane of the horizontal portion 12 of the chin cup 11, having their front ends 18 flattened or otherwise deformed and embedded in said cup portion. The arms 17 are in the form of cylindrical rods of small diameter or stiff wires so as to be rigid or relatively inflexible and are elongated so as to be of greater length than the lower jaw or mandible M of the patient. The arms are adapted to extend throughout the lower margins of the mandible of the patient and, at the inner end of the mandible, each elongate arm is adapted to be bent upwardly to provide an inclined, intermediate portion 19 which extends rearwardly to approximately the lobe of the ear E of the patient. An upright portion 20 is provided at the rear extremity of each arm 17 by forward bending of the rear end of the inclined portion 19, the upright portion being bent rearwardly and downwardly upon itself to form a loop 21 as best shown in FIG. 5. For connecting the arms to each other, a lace, ribbon, or other pliable element or head strap 22 extends between and engages the loops 21 and may be adjustable as shown at 33.

A pair of upright, relatively short arms or members 23, having their lower ends 24 flattened or otherwise deformed and embedded in the upright portion 13 of the chin cup 11, upstands from said cup portion in spaced, parallel
relationship and is in the form of small cylindrical rods or stiff wire like the elongate, substantially horizontal arms 17. Each upright, short arm 23 includes a forwardly inclined, intermediate portion 25 immediately above the upright cup portion and an outer or upper end portion 26 which is substantially vertical and which is disposed forwardly of the chin cup so as to be spaced from the lower lip of the patient (FIG. 4). The upright arms are of a length or are cut to coincide substantially with the elevation of the lower lip and have notches 27 in their front surfaces (FIG. 6) immediately below the extremities of their outer end portions 26 for receiving rubber bands 28 which are adapted to have connection with the teeth T of the patient.

Although the rubber bands 28 may be engaged over molars or other teeth of the patient, usually said patient has been fitted with one or a pair of arch wires 29 and a plurality of metal or plastic bands 30 which are commonly known as "braces" and the lower set of which is shown in FIG. 4. The end portions of each arch wire 29 are adapted to be supported by tubular brackets 31 which are integral parts of the bands 30 of FIG. 4. A depending hook 32 is suitably secured to each band around the last tooth on each side of the arch of teeth for engagement by the inner portion of one of the rubber bands which has its outer portion engaged in the notch 27 of one of the upright arms 23. It is noted that the rubber bands 28 are located above the lower incisors and mandible teeth of the patient or an arch wire mounted thereon; however, if desirable or necessary, additional rubber bands may connect the upright arms to the upper or maxilla teeth or upper arch wire as illustrated.

As diagrammatically illustrated in FIG. 7, the head strap 22 or HS and rubber bands 28 or RB coat to maintain the orthodontic anterior traction appliance 10 in operative position. The force of the rubber bands RB tends to rotate the appliance counterclockwise about the chin C of the patient and is counteracted by the upward restraining force of the head strap HS. The latter force is dependent upon the respective lengths of the elongate or substantially horizontal and upright arms 17 and 23 and, usually, is approximately one-third (1/3) the force exerted by the rubber bands whereby the resulting pressure of the head strap is hardly noticeable by the patient. The resultant vector of force upwardly through the chin in the usual case is approximately one and six-hundredths (1.06) times greater than the force of the rubber bands RB and at an angle of about twenty (20°) degrees to the horizontal, the elevation of the resultant vector through the chin prevents displacement of the cup 11 even when the mandible or head is moved in any direction. It is noted that the appliance is adapted to urge a tooth or teeth forwardly or outwardly in the conventional manner and is free from contact with the soft tissues of the mouth irrespective of mandible and/or head movements.

As shown in FIGS. 8-14, a modified orthodontic protraction appliance 40 may be formed from the appliance 10 and may include the chin cup 11 as well as the upright, short arms 23 thereof. The elongate or substantially horizontal arms 37 may be severed from the cup as shown at 41 in FIGS. 9 and 10, for connection to and use with the upright arms; however, it is obvious that said elongate arms may be omitted entirely and that modified arms 42 may be substituted for said upright arms, as shown. In either event, the upright arms of the modified appliance are substantially identical to the arms 23 and have the same general configuration except for being of less height than the lower lip L of the patient and lacking notches like the notches 27, said arms being cut to fit the patient.

A substantially horizontal arm or member 43, which may be an extension from one of the separations or be arranged to be secured to the outer or upper end of each upright arm 42 in any suitable manner, such as by a tubular elbow 44 (FIG. 13), so as to extend inwardly between the lips and into the mouth of the patient (FIGS. 10 and 11). Each arm 43 includes a horizontal lip or outer portion 45, a downwardly inclined, intermediate portion 46 and an inner or rear horizontal end portion 47 of elongated length. In effect, the substantially horizontal arms, particularly the lip and intermediate portions of 45 and 46 thereof, form rearward continuations of the upright arms. The horizontal portion 47 of each arm 43 is adapted to extend longitudinally of the arch wire 29 and has an upstanding hook 48 suitably secured to its extremity for engagement over said wire (FIG. 12) to slidably suspend the inner or rear portion of the substantially horizontal arm. A depending hook 49 is fastened to the inclined portion 46 of each arm 43 for engagement by the outer portions of the rubber bands 28 which have their inner portions engaged over the hooks 32 of the last dental units of the lower arch and, if desirable or necessary, over similar hooks carried by either the upper or lower arch wires or dental units.

The modified orthodontic anterior traction appliance 40 is usable only in conjunction with a lower arch wire 29, whereas the appliance 10 may be used with or without an arch wire. As nearmost to the lower arch wire, the rubber bands may connect the upright arms to the ends of an upper arch wire as well as to the ends of a lower arch wire. The diagram of FIG. 14 illustrates the vector of force resulting from the combined forces of the rubber bands 28 or RB and the arch wire 29 or AW. Since each substantially horizontal arm 37 has a horizontal portion of the arch length, the ratio between the rubber bands RB and the arch wire AW is about one (1) to one (1) whereby the force at the ends of the arms 43 approximately equals the force of said rubber bands. The tendency of the rubber bands to rotate the appliance counterclockwise is opposed by the support provided by the engagement of the hooks 48 with the lower arch wire. The resulting vector of force upwardly through the chin is approximately one and four-tenths (1.4) times greater than the force of the rubber bands 28 or RB and is at an angle of about forty-five (45°) degrees to the horizontal.

The modified appliance has the minor disadvantage of a greater amount of force being exerted on the chin with the same rubber band strength and the advantage of better esthetics since only a portion of said appliance is visible and no head strap is employed. The depressing action exerted on the lower arch wire by the suspension of the substantially horizontal arms therefrom may be useful in treating cases of "open bite." Both appliances are esthetically more pleasing than conventional orthodontic anterior traction appliances, custom made to mandible movements when mandible movements are separated and assembled for quick mounting, are more comfortable to the patient, have greater stability, are easier for the patient to remove and replace, and are less bulky. One of the most important features of the invention resides in the stability provided by the substantially horizontal arms.

The foregoing description of the invention is explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction may be made, within the scope of the appended claims, without departing from the spirit of the invention.

What I claim and desire to secure by Letters Patent is:

1. An orthodontic anterior traction appliance including a cup for engaging the chin of a patient, a pair of upright rigid arms upstanding from the chin cup and of a length sufficient to coincide substantially with the elevation of the lower lip of the patient, elastic means extending between and having connection with the upright arms and braces on the teeth of the patient for urging the teeth forwardly of the mouth of the patient, a pair of substantially horizontal rigid arms extending rearwardly of said chin cup and from arms 17, in operative connection therewith, and means connected to the rear portions of the substantially horizontal arms for preventing downward movement of said rear portions whereby said substantially horizontal arms coat with said upright arms to provide a resultant...
vector of force for holding said cup against displacement, said rear portions of the substantially horizontal arms extend upwardly behind the mandible to the ears of the patient.

2. An orthodontic anterior traction appliance as set forth in claim 1 wherein the substantially horizontal arms are secured to and extend rearwardly from the lower portion of the chin cup throughout the lower margins of the mandible of the patient, the means connected to the rear portions of said arms for preventing downward movement of said rear portions including a pliable element extending between said rear portions over the head of the patient.

3. An orthodontic anterior traction appliance including a cup for engaging the chin of a patient, a pair of upright rigid arms upstanding from the cup and of a length sufficient to coincide substantially with the elevation of the lower lip of the patient, elastic means extending between and having connection with the upright arms and with braces on the teeth of the patient for urging the teeth forwardly of the mouth of the patient, a pair of substantially horizontal rigid arms secured to and extending rearwardly of the upper ends of said upright arms so as to form continuations thereof which extend rearwardly into the mouth along and externally of the teeth of the patient, and means extending between and having connection with the rear portions of the substantially horizontal arms and the mandible teeth of the patient for preventing downward movement of said rear portions whereby said substantially horizontal arms coact with said upright arms to provide a resultant vector of force for holding said cup against displacement.

4. An orthodontic anterior traction appliance as set forth in claim 3 including arch wire mounted on the mandible teeth of the patient, the last-named means being connected to the rear portions of the substantially horizontal arms and being engaged over the rear portions of the arch wire so as to suspend said arms from said arch wire.

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