THE EVOLUTION OF THE PRINCIPLES OF JACKSON APPLIANCES

By JOSEPH D. EBY, D.D.S., ATLANTA, GA.

Professor of Orthodontia, Atlanta Dental College, Atlanta, Ga.

PART III.

Construction of Removable Jackson Appliances

PREPARATION OF MODELS.

INASMUCH as Jackson appliances are made over models by a process of off-hand construction and assembling of the parts, the casts should be perfect, and the greatest care should be given to preserving the anatomical outlines over which the parts are made.

The best assurance of perfect-fitting appliances is the use of models made only from plaster impressions. The model material should be the finest grade

Fig. 7.

of plaster of paris. If any of the very hard compositions of modeling material are used, or if the plaster of paris is boiled in stearine or paraffin, the possibility of exercising correct technic is lost.

Models should not only be made of plain plaster, but must be used moist. When the numerous parts are made over dry plaster surfaces, they have to be removed, set aside, and assembled when all parts are finished. By this plan the desired accuracy is lost because the construction is a progressive process of building one part upon another, from the first to the last, and if the parts first made are removed, it is impossible to make allowances for the subsequent parts

Fig. 8.

Fig. 9.

to fit over them accurately. If the model plaster is moistened, the individual parts have sufficient adherence to remain in position, allowing the advanced steps to be taken with accurate calculation of size.

CARVING MODELS.

After the design of appliance has been determined, the next step is the carving of the cervical borders of the posterior teeth selected to bear the "partial clasps" lingually and the "spring clasps" buccally. Dr. Jackson has always emphasized this point, for the security of anchorage depends on the use of the cervical constrictions.

Along the linguo-cervical borders of all posterior teeth which are to bear "partial clasps" a very thin, sharp-pointed instrument should be drawn to make a narrow groove to represent the natural space between the cervix and the gingival border of the free margin of the gum. This instrument should be inserted at an angle of approximately 35 degrees from the axis of the tooth to carve out the groove anatomically correctly (Fig. 7).

The bucco-cervical borders of teeth to bear spring clasps must be brought out clearly by trimming away the slightest possible amount of the outlines of the free margins of the gums. To do this, the instrument should approach the surface at right angles from the axis of the tooth (Fig. 8). The surplus left between this line and the buccal surface can be carved away, thus opening a distinct outline of the bucco-cervical border to which to fit the clasp (Fig. 9).

PARTIAL CLASPS.

The next step is the construction of "partial clasps." "Partial clasps" are made of partial clasp gold, a material specially prepared by Dr. Jackson for this purpose. It is a stiff 36-gauge plate metal, possessing a specially treated surface on one side for a very tenacious adhesion with the tin solder, and a pure gold surface for contact against the teeth. This material will respond to the contouring plier without annealing, but it is made specially hard to prevent the borders from curling out of the cervical constrictions under the operation of insertion and withdrawal.

The success of attachment depends greatly on the adaptation of the partial clasps into the linguo-cervical constrictions of the anchor teeth, held in position by the spring clasps buccally. As these borders glide over the convex lingual surfaces during removal and insertion, they would be bent outward if made of soft material, causing the apparatus to loosen. This strain will also cause a weak solder connection to loosen, so that the partial clasps will scale off, leaving only a solder surface in loose contact with the tooth. For these two principal reasons this material has no substitute, and, being the first step in the construction, failure here results in complete failure of the appliance.

Partial clasps are to be fitted to all the posterior teeth engaged in the arms of the appliances for anchorage. They must be fitted with perfect accuracy well into the cervical constrictions, slightly beneath the free marginal outlines of the gums. The ends of the partial clasps should extend to the mesial and distal aspects of the lingual surfaces, but not into the proximal surfaces. If these ends project too far interproximally, they prevent the appliance from seating, wedge the teeth, and cause painful injury to the interproximal tissue.

Partial clasps should extend toward the lingual cusps, slightly occlusally to the point of greatest curve of the lingual surfaces, but not far enough to interfere with the occlusion (Fig. 10).

The treated surface of the metal must be faced outward, with the pure gold surface touching the model, and this specially treated surface can be readily distinguished by its color and finish. A wider strip should always be cut for the molars than for the premolars in order to keep the occlusal borders on a straight line mesio-distally.

Fig. 10.

Fig. 11.

Fig. 12.

The contouring plier (Fig. 11) will conform the strips to the double curve of the lingual surface to any desired length. After trimming the cervical border to fit perfectly, the partial clasp should be carried to place, with the curve of the plate smaller than the curve of the lingual surface of the tooth, and it can then be enlarged by pressing it to position, where it will remain securely (Fig. 12).

SPRING CLASPS.

Spring clasps are divided into two forms—full and partial. The full spring clasp entirely encircles the tooth, crossing from the lingual to the bucco-cervical

constrictions over the interproximo-occlusal grooves, with both ends attached in the solder. This design is typical of the removable appliance.

The partial spring clasp only partially encircles the tooth, crossing over only the mesial or the distal interproximo-occlusal groove, traversing the bucco-cervical constriction, terminating at the opposite proximal side whence it crossed for attachment lingually. This clasp is used both in the fixed-removable and the removable types. Two spring clasps are employed on both sides of the arch

Fig. 13.

Fig. 14.

to secure balance of attachment, and are usually placed on the most anterior and most distal teeth engaged in the arms of the appliance.

Spring clasps are made of 21-gauge and 20-gauge special alloy nickel silver wire. Number 21 gauge is generally indicated in all partial spring clasps and also in the full spring clasps, excepting for specially large teeth. The wire should be cut into between two- and three-inch lengths, and the bending begun in the middle to permit of free holding for bending until the clasp is complete. The clasp wire should first be bent to the curve of the gum scallop on the buccal surface, with the two ends pointing occlusally to the proximal sides.

After this the second step is to bend this bucco-cervical portion into a second curve, the curve of the bucco-cervical constriction, mesio-distally. For this it is necessary to use the brace of a rubber block to control the bending accurately (Fig. 13).

The third bend requires the greatest accuracy because it forms the angle between the buccal and occlusal surfaces. If this bend is too high, it causes the occlusal portion to interfere in occlusion; if it is bent too low, the bucco-cervical region will be too short on the teeth to reach the cervical constriction. To grasp the wire accurately, the operator should possess a medium-length left thumb nail, so it can make the grasp accurately (Fig. 14), bringing off the wire so the end of the round-nosed plier can pick up the exact point by running it down over

Fig. 15.

Fig. 16.

the surface of the thumb nail (Fig. 15). It is far better to continually under-bend, trying to position frequently, and in this way continue progressively. By bending too far, the work has to be undone, started over again, and usually the part is ruined by inaccuracy and breakage by crystallizing the wire.

In making full spring clasps, the mesial and distal portions should be carried across the occlusal surfaces together, for, if one side is finished first, the clasp is liable to be warped. After fitting across the occlusal surfaces, the ends are bent downward, to be curved around midway of the partial clasps for soldering. The mesial end should be bent to traverse the entire length of the partial

clasp distally and *vice versa*, so as to gain a strong mechanical attachment in the solder. If these ends are cut short, they may pull out of the tin, which is caused by a mild galvanic corrosion which gradually makes ingress between the wire and the tin, loosening the adhesion a short length around the wire at the point of entrance into the tin, causing a short straight end to pull out.

It is also important to extend the ends of the spring clasp wires to rest against all partial clasps not engaged (Fig. 16). If this is not done, the attraction of the molten tin as it is drawn over the partial clasps on the soldering iron is liable to pull them off or displace them slightly.

After finishing the partial clasps and the spring clasps, the anchorage or "arms" are completed. It is best to unite the number of small parts at this juncture, reducing to one unit on each side the five to ten small parts which are very important to preserve accurately, and which are liable to displacement during the advanced steps.

The weight of the soldering iron against the lingual ends of the clasps is liable to elevate the bucco-cervical portions, where the greatest accuracy is re-

Fig. 17.

Fig. 18.

quired. To prevent this, pins should be inserted to hold the clasps very securely in place (Fig. 16). The thinnest film of solder possible to make the attachment should be used to keep down the bulk of the appliance (Fig. 17).

The next step is the construction of the "base wires," or "body wires," for the connection of the anchor "arms" across the palate in the upper end and in the sublingual region in the lower.

BODY WIRES OR BASE WIRES.

The body wires are made of 12-gauge for average cases, although the gauge should range from 9-gauge to 14-gauge, varying with age, extent of development required, control of bulk, etc. The body wire can be made into a number of different designs, but the best plan to follow is to use the simplest form suited for the needs required.

The simplest form of upper body wire is made for premolar and anterior expansion only (Fig. 18). This form is made by bending a piece of wire about 6 inches long into a U-shape to fit around the dome of the palate at the desired point across the molar region.

Care must be taken, in determining the points, to bend the ends forward from the points of contact against the molars. If these angles are too high, they will interfere with the occlusion and impart bulk and bad finish. The measurement should be taken with the thumb-nail grasp, and should be made low enough so that the *outer curve* of the wire will only touch, or, failing to touch, will approximate closely the linguo-cervical borders of the molars.

In all heavy wire bending, special care must be taken to calculate the position of the outer curves, and to do this the wire must be grasped in the pliers at a point the diameter of the wire away from the desired point of the bend,

Fig. 19.

Fig. 20.

Fig. 21.

so as to make this allowance in the height of the curve. The palatal part of the wire should enter the sides about midway of the lingual surface of the distal teeth engaged in the appliance, and the ends should always extend forward or backward, as the case may be in the different designs, to about midway of the lingual surface of the tooth at the opposite end of the anchor arms. This will impart a round finish at the ends, which is lost if the ends project beyond these points.

It is absolutely necessary for the side parts of the body wires to extend the full length of the anchor arms to render them rigid. Because the linguo-cervical borders of the molars are higher than the premolars, it will be found that, as the

sides of the body wires extend forward, a space will be formed between the wire and the partial clasps on the premolars. It is in this space, that the ends of the anterior extensions must be fitted and soldered, and the size of the space may be determined by the number of springs to be used (Fig. 18).

Fig. 19 illustrates a body wire for premolar expansion and molar expansion on one side only. Fig. 20 illustrates a body wire for bicuspid and molar expansion on both sides. These are made by bending the wire into the U-shape on the curve of the palate at the posterior region, and then the forward bends are made, to be looped back parallel around the jaw of a round-nosed plier, so that the end will terminate at the molars. Care must be taken to preserve the space in the bicuspid regions for the anterior springs, and this list loop must not be higher than the cervical zone, so that the finished appliance will not interfere occlusally.

The form of body wire found to be most effective for premolar and molar expansion on both sides is shown in Fig. 21. This design contains less material

Fig. 22.

Fig. 23.

than the one in Fig. 20, and responds to the lines of lateral development with better effect. In constructing this style of body wires, the wire is first bent into a U-shape, to rest in the dome antero-posteriorly, with the ends pointing distally. The ends are then looped over the jaw of the round-nosed plier and brought forward, observing the same precautions as to position and terminating midway of the lingual surfaces of the teeth at the anterior ends of the anchor arms. Body wires *must not* touch the soft tissues at any point. After construction, they may be held to position with moldine, and should be tacked to place with a very little solder on both sides (Fig. 21). The finer bending of these heavy wires (Fig. 22) can be made to the best advantage with a plier designed by Dr. Case (Fig. 23). Soldering the body wire to position completes the body and arm portions.

FINGER SPRINGS.

All extensions of springs from these parts are known as "finger springs" or "fingers." "Fingers" are made of Nos. 18-, 19-, and 20-gauge wire, and are

adjusted usually to the surfaces of teeth opposite the direction of movement. "Fingers" vary in design with every individual case.

Careful comparison of a given irregularity with the normal, and measurements to determine the extent and direction of tooth movement, may show the path of movement toward the normal to be such that the arch may be corrected in segments and the study of other conditions may show that all teeth must

Fig. 24.

Fig. 25.

move on individual paths. The effectiveness of the Jackson method is its great adaptability of design to meet varying needs with equal advantage and facility.

Fig. 24 illustrates a condition caused by the premature extraction of the left deciduous cuspid, which, by breaking the proximal continuity of the arch, allowed the muscles to narrow the two posterior segments and drift the incisors lingually from the right cuspid at the center of the rotary axis. The molar ex-

panding body wire is indicated for restoring the two posterior segments to normal width.

One lingual "finger" bent on the normal curve of the lingual surfaces should be attached to the right arm of the appliance. By rendering this finger active with the right cuspid at the rotary center, the path of movement of each incisor will be determined by the radius of the spring from the central axis to the point of contact at each tooth. The path of movement of the left lateral will be outward and to the right on a greater arc than that of the left central. The path of movement of the left central will be on a greater arc than that of the right central. The path of the movement of the right central will be on a greater arc than that of the right lateral. By the pressure of this spring, each incisor will be moved along different paths toward their normal positions, restoring normal incisal relations and concentrating the space gained for the left cuspid.

SOLDERING.

The appliance is shown in Fig. 25 prepared for the finishing soldering on the right side. The "finger" is held to position with moldine, and the spring

Fig. 26.

Fig. 27.

clasps are repinned to place to prevent them from slipping buccally. Zinc chloride is now applied to the entire side freely. The hot iron is dipped continually into the flux before soldering to keep it well tinned and clean. Globules of pure block tin are carried by the iron and flowed well down into the crevasse between the clasps and the body wire. Enough solder should be applied to slightly round off the exposed surface, to impart a smooth finish.

Fig. 26 shows the buccal aspect of the left side finished. A buccal "finger" has been extended to press the cuspid into alignment after ample space is made for it. This illustration also shows how the spring clasps have been shifted to the second premolar and second molar on this side to prevent the need of two wires crossing the occlusion between the first premolar and the canine.

Fig. 27 illustrates the exposed aspect of the soldered appliance ready for removal from the model for the first time for polishing. It also shows the laterals collared with lugs, soldered to the lingual surfaces, beneath which the "finger" snaps to be held securely to position. Here we have an interesting il-

illustration of the control of shifting anchorage for which the Jackson system is noted. All of the posterior teeth are anchored against the labial movement of the incisors. The incisors and right posterior teeth are anchored against the left posterior teeth (ten anchor teeth against four teeth to be moved), which have moved lingually more on the right side. The exposed surface of the appliance removed from the model is shown in Fig. 28.

TRIMMING AND POLISHING.

After a sufficient amount of tin is added to the sides of the arms, it should all be melted along the full length at one time. This will cause it to harden with

Fig. 28.

Fig. 29.

a uniformly smooth surface, which will require only a few strokes from a sand-paper disk to prepare for the lathe polishing. The lingual side of an appliance requires very careful attention in polishing. Sharp projections of the partial clasps extending too far interproximally should be cut away. When the solder runs around the ends of all of the wires, completely enveloping them, it is cast against a strip of plaster representing the outlines of the free margin of the gums. If this solder should touch the soft tissues, a slight compression will be

established as the appliance settles. This pressure will exclude the circulation from the capillary terminals and will devitalize strips of tissue, which will resolve into a dense white mass. To avoid this, the palatal side of the tin between the cervical borders of the partial clasps and the body wire should be cut out a reasonable depth, forming a smooth concave surface, with a self-cleansing space between the appliance and the gums (Fig. 29). Great care should be taken in this step to not injure the cervical borders of the partial clasps. They should be left projecting well up above the tin, to enter the cervical constriction at the gum borders. Fig. 30 illustrates this, showing a cross-section cut through the middle of the molar clasps.

After smoothing all sharp points to be found and rounding the ends of the "finger" springs, appliances are to be polished with the lathe. A felt wheel should

Fig. 30.

be used with a stiff mixture of pumice for the exposed surfaces of the tin, which will make the tin very smooth. The palatal portion of the tin can be polished with bristle brush wheels with ample pumice.

After removing all tool scratches with pumice, a luster can be imparted by washing off the pumice, drying the appliance, and reapplying the same brush wheel with which the pumice was used, when the moist bristles with the slight amount of remaining pumice will impart a lasting finish. The final luster can also be made with prepared chalk paste on a camel's-hair wheel.

Jackson appliances retain a triple plate of gold very beautifully. Plated appliances cannot be cleansed so well as the plain surfaces and are more conspicuous.

The next number will continue construction designs and manipulation of Jackson appliances.

A UNIQUE METHOD OF MOUNTING PHOTOGRAPHS

BY CARL O. ENGSTROM, D.D.S., SACRAMENTO, CAL.

THE accompanying photograph presents a case of Class II, Division 1, showing three juxtaposed side views of the face, each illustrating a stage in the treatment. The first view was taken in January, 1915, at which time treatment was begun. The second was made June, 1915, or two months before the placement of the retaining appliances, and the third was made January, 1916. In comparison with separate photographs, this combination of views shows to better advantage the changes that occurred as the result of orthodontic treatment. In looking from one object to another, distraction of the mind is natural, and the amount of distraction is in direct proportion to the distance of separation.