

A Discussion of Torque Force*

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While the use of torque is not so universally necessary with the Edgewise Arch as it was with the Ribbon Arch, it is extremely advantageous in certain areas and under certain conditions. Its use is almost entirely contra-indicated as a source of increased anchorage, for with all teeth banded and with a stationary anchorage provided in two planes of space, this additional anchorage is not necessary. Those men who are placing it in lower incisors on Class II cases, are wasting time and adding nothing to the efficiency of their appliance.

The area where it is used most often to advantage, is the buccal segment when jumping the bite is called for in conjunction with expansion. There are, of course, other indications for its use but it is rarely necessary for such things as straightening up individual teeth, etc.

Just for a moment let us examine the physiological laws that lie behind this type of mechanics. Oppenheim demonstrated the fact that when a simple pulling force was exerted on a tooth, the first bone change that took place was at the gingival margin and that it progressed down the length of the root until the apex was reached. In short, the tooth acted like a simple lever with its apex as the pivot or fulcrum. When a bracket attachment connects a tooth to a flat-sided arch, it is possible to modify this picture so that the root apex is caused to move, while the archwire becomes the center of rotation, or it is possible to accelerate tipping from the apex. The result will depend on just one thing, the control of the other portions of the archwire. If the archwire is held so that it cannot move, the result will be a root movement, if the archwire is encouraged to move *with* the tooth, a tipping will result.

If we now examine the principle of the second order bend, we find exactly the same physiological law being invoked. If the archwire is kept from moving, the result will be a root movement, if it is free to move with the teeth the result will be a tip. Hence, so far as the nature of the tissue reaction is concerned, these two forces are identical, the difference lies in the fact that one is applied in a labio- or bucco-lingual plane by twisting the archwire while the other is applied in mesio-distal direction by bending the archwire. In both cases the same law holds as to a release of the archwire when crown movement is desired.

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In common with all forms of force, torque force responds to two fundamental laws. 1—A force travels in the straight line and 2—action and reaction are equal and opposite. If we have a torque in the buccal area, it does not travel beyond the cuspid point, for the line of force is at right angles from here on. Torque and second order bends both become translated into depression or elevation in the anterior segment. Thus in the Ribbon Arch, a molar torque force had its next point of attachment or its reaction in a different plane of space where it was translated into depression or elevation.

With all of the teeth in the buccal segment banded, the picture is considerably altered. Here we are dealing with a force that remains in the same plane or line and hence follows the action and reaction law. Thus if we torque a molar, our next point of attachment will be the second bicuspid and here the action will be equal and opposite, or a torque in an opposite direction. If this is not desired we must move this force along until we reach a place where it *is* desired or where we go into another plane of space, thus changing the nature and effect of the reaction. This accounts for the fact that torque has to be increased as we go distally from the cuspid. I believe that Dr. Strang's method of placing this mass torque can be improved upon in such a way that the excessive torquing of the molar segment will not alarm the beginner. My method is as follows:

The arch is marked as Dr. Strang has advocated or as I prefer, opposite the interproximal spaces of the buccal teeth and then a torque bend is placed *first* at the mesial molar area. The archwire is then placed in this tube and its relation noted at the opposite tube. For a buccal torque this should be about $\frac{1}{8}$ " above or gingival to the tube. This will seem very slight to the man who used the Ribbon Arch but it should be remembered that our lever extends not to the incisors but only to the second bicuspid. Its range is short and therefore very powerful.

Now if we place the archwire in the second bicuspid bracket we will find that the opposite end again lies at the level of the tube. Hence we must place enough torque anterior to the second bicuspid bracket to cause the arch to once more lie $\frac{1}{8}$ " gingival to the opposite tube. Thus the archwire is torqued mesial to each of the buccal brackets but it should always be tested by placing it in all of the attachments posterior to the last twist. When the operator has done this, he will not be so frightened when he introduces the archwire on the torqued side and sees it curl up until it lies almost vertically.

I shall not discuss torque at the cuspid area but I would utter a word of warning to go slowly here and to analyze carefully what you are going

to do. If we consider the buccal segment and the anterior segment as lying in planes at right angles to each other and if we consider the cuspid as belonging to both segments, we see that here we have a third plane which truncates the angle formed by the other two. From the purely mechanical aspect this is exactly the condition we are faced with and we can meet with this in mind, as Dr. Strang has outlined, or we can throw the cuspid into one or the other of the segments by placing our bracket either to the mesial or distal of the eminence and our twist correspondingly.

There is no mechanical principle in orthodontia so difficult to grasp as torque and it should be studied diligently before it is placed in operation on a patient. Its effectiveness will depend on the operator's knowledge of tissue reaction to various kinds of force and under this heading I would reiterate the cardinal principles that govern its action.

1. If the archwire is held so that its axis cannot shift the result will be a root movement in the opposite direction.
2. If the archwire is encouraged to travel with the teeth, they will tip with the apex as a pivot.
3. Torque force becomes elevation or depression when it travels into another plane of space.
4. In the newest mechanism, with all teeth banded, torque force on one tooth will result in an opposite torque force on the next tooth if it is in the same line.

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