Some appropriate anchorages for removable orthodontics appliance

Beberapa penjangkar yang sesuai untuk piranti ortodontik lepasan

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ABSTRACT

Orthodontic movement of a tooth or group of teeth occurs due to the application of the force applied by active components and these acting forces always generate reciprocal forces of the same magnitude but opposite in direction which follows Newton's third law. Basically, anchoring management aims to keep the force used light and increase anchoring resistance, so that the gear that is expected to move while the teeth that are not expected to move can be held or minimized. During treatment, anchorage loss must be detected immediately, the cause searched, and dealt with as soon as possible so that no more severe errors occur so that the treatment results can be as good as possible. The purpose of this paper is to examine how to manage anchoring problems in orthodontic treatment using removable appliance, especially active removable appliance so that treatment results achieve satisfactory results.
Keywords: anchorage, removable orthodontic appliance

ABSTRAK

Pergerakan ortodontik suatu atau sekelompok gigi terjadi karena penerapan gaya yang diterapkan oleh komponen aktif dan gaya aksi ini selalu menghasilkan gaya timbal balik dengan magnitudo yang sama tetapi berlawanan arah dengan mengikuti hukum ketiga Newton. Pada dasarnya, manajemen penjangkar bertujuan untuk menjaga agar kekuatan yang digunakan tetap ringan dan meningkatkan tahanan penjangkar, sehingga gigi yang diharapkan bergerak sementara gigi yang tidak diharapkan bergerak dapat ditahan atau diminimalkan. Selama perawatan, kehilangan penjangkar harus dideteksi segera, penyebabnya dicari, dan segera ditangani sehingga tidak terjadi kesalahan yang lebih parah dan hasil perawatan seadekuat mungkin. Tujuan dari makalah ini adalah menjelaskan bagaimana mengelola masalah penjangkar pada perawatan ortodontik menggunakan alat lepasan, khususnya piranti lepasan aktif sehingga hasil perawatan mencapai hasil yang memuaskan.
Keywords: anchorage, removable orthodontic appliance

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INTRODUCTION

A removable orthodontic appliance is defined as an appliance that can be installed and removed by the patient himself. This appliance began to be routinely used since the 19th century; acrylic and stainless steel were only used in the early of 20th century. Around 1950, Adam[1] developed a hedge so that the scope of use and efficiency of removable appliance increased. Before fixed appliance developed, removable appliance was used to treat almost all cases of malocclusion. With the development of science and technology in the field of orthodontics, the use of removable appliance is displaced by fixed appliance, but this appliance is still an option for handling certain cases.[2,3] Kerr[3] reported that 85% of the population treated using removable appliance with truly selected cases showed satisfactory results.

Removable appliance consists of various kinds. Removable appliance can be used as an active tooth movement appliance, for example in interceptive cases in mixed dental patients, space maintainers, functional appliance for growth modification treatments, post-treatment retention appliance using fixed appliances, and clear aligners.[1,2] Lately the use of removable appliance more broadly because it can be combined with bands, hooks, and oral accessories. Nevertheless, it must be stressed that removable appliance is not an option for dealing with complex malocclusions.[2]

General dentists will be able to treat orthodontic cases using removable appliance if they have enough skills and expertise, plan carefully, choose appropriate cases, and conduct careful care supervision. One problem that is still difficult to overcome in the use of removable appliance is how to control anchoring to avoid anchorage loss.

The purpose of this paper is to discuss how to manage anchoring problems in orthodontic treatment using removable appliance, especially active removable appliance so that treatment results achieve satisfactory results.

Using removable appliance in orthodontic treatment

In general, patients choose removable appliances for reasons of lower cost, easy to install and uninstall, and easy to clean. However, this appliance is easily

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broken or even lost, often disrupting the function of speech, and use in the lower jaw is more difficult to tolerate than the upper jaw so patients rarely use it full time. Based on the dentist's perspective, removable appliance also has advantages, including anchoring can be obtained from the palate and can be used in pediatric patients to reduce overjet. But this appliance has disadvantage of movement that can be produced only by tipping, it is difficult to produce intermaxillary anchoring, it is not effective for the movement of a number of teeth simultaneously, and because the appliance is a laboratory-made, it requires adequate skills and expertise. Considering that the capability of removable appliance is very limited, cases that can be treated using this type of appliance must be limited. [4,5]

According to Proffit[2], the use of removable appliance is intended for cases that can be overcome by expanding the dental arch, moving the teeth so that they occupy wider arches or reposition the teeth individually to enter into the arch. Muir[4] indicates a removable appliance for 1) skeletal malocclusion ranges from class I. The reduction or addition of overjet is limited to what can be corrected by changing the inclination of the incisors; 2) treatment can be performed only on one jaw, for example the upper jaw uses a removable appliance while the lower jaw is not treated, 3) malposition of individual teeth where the apical position can be corrected by tipping, 4) treatment with retraction that requires only tipping movements to close the retraction chamber, 5) malocclusion in buccolingual direction followed by mandibular displacement, for example unilateral crossbite of posterior teeth, 6) closing of the extraction chamber which leaves room so that the buccal segment teeth must be advanced.

The contraindications for using removable appliance are 1) real skeletal malocclusion, for example protrusive bimaxillary class I, skeletal class II and class III, skeletal deepbite or deepbite; 2) treatment that requires improvement of dental relations between the upper and lower jaw; 3) severe apical position and tooth rotation abnormalities, involving many roots; 4) requires bodily movements; 5) abnormalities in the vertical direction such as deepbite, openbite, and dental altitude abnormalities; 6) problems of lack or excess of a large room.[4]

Cases that are indicated for removable appliance should also consider the age factor. Removable appliance is more suitable for patients aged 6-16 years, where more treatment time utilizes the final period of mixed teeth and the beginning of period of permanent teeth.[1]

Anchorage in removable orthodontic appliance

Orthodontic movement of a tooth or group of teeth occurs due to the application of the force applied by active components, such as spring, wire arc, elastic, or expansion screws. When the teeth are moved, the reaction force will be channeled through the appliance so that it tends to produce the movement of other teeth in the opposite direction (Fig.1). This situation is in accordance with Newton's 3rd Law which says that every action produces a reaction of equal magnitude and opposite direction. The problem is how to avoid the detrimental effects of these opposing forces, because the expected goal of a treatment is to move the desired gear while the other structure is not moving.

The ability to withstand the forces produced by active components is called anchorage. The control of anchorage is intended to produce the desired tooth movement as much as possible while the tooth movement that is not expected to be held or as small as possible. Anchorage can be obtained intra-oral or extra-oral, but intra-oral anchorage is more commonly used in removable appliance.[1,6,7]

Anchorage is a word used in orthodontics which means resistance to displacement. Each orthodontic

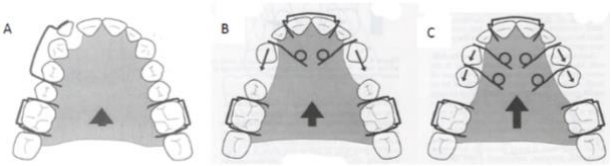

Figure 1 Anchorage is related to the number of teeth moved; **A** moving a gear produces satisfying anchoring, **B** if 13 and 23 are retracted, the anchor teeth move forward, **C** if 14,13,23, 24 are retracted together, the number of teeth moved is greater than the anchor teeth, then anchorage will not be strong, the possibility of anchorage loss (Source: Isaacson KG, Muir JD, Reed RT. Removable orthodontic appliances. Singapore: Elsevier; 2002. p.1-2, 39-46, 93-7).[1]

appliance consists of two active elements and resistance elements. The active part is related to tooth movement. The resistance unit provides resistance or anchoring that allows movement of the teeth. In orthodontics all of anchorage is relative and all resistances are comparative. During orthodontic treatment, teeth are exposed to strength and moment, and the strength of this action always produces reciprocal strength with the same force but in opposite direction. To avoid unwanted tooth movement and maintain successful treatment, this reciprocal force must be diverted or resisted. The dentist must decide where resistance to strength is needed to produce the desired tooth movement. Utilization of tooth unit resistance must be the first consideration. If this proves inadequate, it must be added by other anchorage sources, both intraoral, extra oral, or both. The skeletal anchors expand the range of biochemical possibilities with screws, pins, or removable implants attached to the jaw, so that force can be applied to produce tooth movement in all directions without adverse reciprocal forces. Orthodontic force can be applied di-

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rectly to the jaw through skeletal anchorage. An intraoral skeletal anchor unit that is predictably stable, relatively unobtrusive, biocompatible, and comfortable make appliance design simplified and more efficient.[8]

Moyers's classification[8]

According to the way of applying force, there are some anchorages: simple anchorage that is resistant to tips, stationary anchorage that is resistance to body movements, and reciprocal anchorage that are two or more teeth move in opposite directions and are pitted against each other by an appliance.

Simple anchorage is a dental anchor in which the manner and application of force tends to move or to change the axial tendencies of the teeth or teeth that form anchorage units in the spatial plane where the force is applied. In other word the anchor unit's resistance to the tip is used to move teeth or other teeth.

Stationary anchorage is a gear anchor in which the manner and application of force tends to physically move the anchorage unit in the plane of space where the force applied is called stationary anchorage.

Reciprocal anchorage involves pitting two teeth or two groups of teeth that have the same anchor value to each other to produce reciprocal tooth movements for example: diastema closure, two central incisors with each other.

Reinforced anchorage involves strengthening the anchorage or resistance area either by adding more resistance units or by using various additions. A simple way to strengthen the anchor is to tie the second molar. Various other ways include, the use of TPA, the arch holding Nance, the lower lingual arch. Tissue anchorage as obtained with a lip bumper can be efficiently used to distort molars.

According to the jaws involved intra maxillary: anchorage is established in the same jaw, and inter maxillary: anchorage is distributed to both jaws or Baker's anchorage. Based on anchorage location, 1) intra oral: anchorage is obtained inside the mouth, 2) extra oral: anchorage is obtained outside the mouth, for example a) cervix: e.g. neck strap, b) occipital: e.g. head, c) cranial: e.g. high pull headgear, and d) facials: e.g. face mask; and 3) muscular: anchorage comes from muscle action, for example vestibular shield.

Based on the number of anchorage units, 1) single or primary anchorage: anchorage only involves one tooth, 2) compound anchorage: anchorage involving two or more teeth, and 3) reinforced anchorage: adding a non-dental anchor location. For example mucosa, muscles, head, etc.

Intra oral anchorage

The anchorage must have a holding force of at least equal to or greater than the force given by the active components in the opposite direction usually there will be a slight movement of anchor teeth which depends on the number of teeth moved by the type of anchor can be seen in the anchorage scheme as follows. An anchor is called intraoral anchorage if the anchor is in the mouth while the extraoral anchor is outside the mouth.[9]

There are two kinds of intra-oral anchorage, namely intramaxillary and intermaxillary anchorage. Intramaxillary anchorage is obtained from the same arch jaw. This type of anchorage is often chosen in the use of active removable appliance. Understanding intramaxillary anchorage is an anchor located in the same jaw as a tooth moved. The Figure shows when moving intensively the upper incisors to the palatal first permanent molar of the second premolar and permanent canines are anchors.[9] Intramaxillary anchorage can be obtained from the teeth that are used as a backbone or tooth support teeth that are held in place by a labial arc, a plate that adapts well to the palate and with a toothless surface, and interdigitation between the maxillary and mandibular teeth.[1]

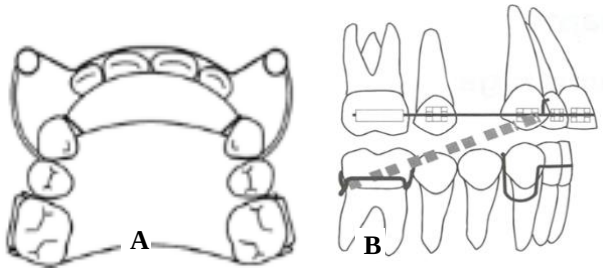

Figure 2 The anchorage; **A** intramaxillary, **B** intermaxillary (Source: Isaacson KG, Muir JD, Reed RT. Removable orthodontic appliances. Singapore: Elsevier; 2002. p.1-2, 39-46, 93-7).[1]

Intermaxillary anchorage uses the opponent's arch to obtain anchoring. This type of anchorage is commonly used in the treatment of functional and fixed appliances, but it is difficult to apply to the use of removable appliance for active movement of teeth because it tends to release the appliance. It will be moved to the upper jaw while the anchor is located on the lower jaw. Intermaxillary anchorage have been used on removable appliance because removable appliance which become anchors will easily be detached because of the elastic attraction that is installed between the two appliances.[9]

Intermaxillary anchorage can be obtained from the use of removable appliance combined with fixed appliance in one of the jaws. One example is the case in class II malocclusion with a good arrangement of mandibular teeth. In the lower jaw a removable appliance is used with a hook attached to the hollows of the molars to connect the elastic intermaxillary to produce pull for the anterior segment of the fixed appliance attached to the upper jaw (Fig.2). In the case of class III malocclu-

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sions, the maxillary removable appliance can be used to produce class III traction, and an expansion appliance can also be used to proclaim incisor segments.[1]

Elastic fixed upper and lower removable appliance are used as anchor. Retention of removable implements should be good, and Adam's clasp are modified with a hook for elastic hooks.[1]

The main sources of intraoral anchorage are teeth that are not moved by the appliance through the clasp and in contact with the acrylic plate. Stationary anchorage, which means the anchor teeth do not move at all, can never be used on removable appliance.

Intraoral anchorage which is often used can be in the form of simple anchorage which is an anchorage that uses teeth that have greater resistance as anchors to move teeth that have smaller resistance. Fig.3A shows the movement of tooth 43, has smaller resistance, distally using 46 as a guard because the first molar has greater resistance. In Fig.3B it can be seen when moving 16 distal teeth that all maxillary teeth are anchors, known as compound anchorage.[9]

Figure 3A Simple anchorage, **B** compound anchorage (Source: Isaacson KG, Muir JD, Reed RT. Removable orthodontic appliances. Singapore: Elsevier; 2002. p.1-2, 39-46, 93-7).[1]

Reciprocal anchorage is when two teeth or groups of teeth that have equal resistance move in the opposite direction. In Fig.4A can be seen to close the central diastema of the first right and left incisors moving in the opposite direction to one another anchor. Fig.4B when the screw is activated, the posterior teeth move to the transverse teeth as anchor to other posterior teeth.[9]

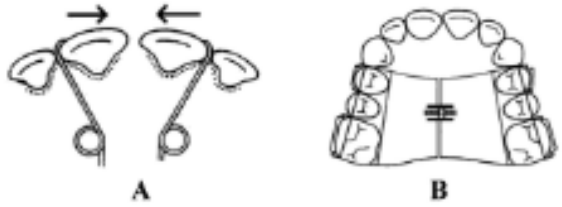

Figure 4 Reciprocal anchorage (Source: Isaacson KG, Muir JD, Reed RT. Removable orthodontic appliances. Singapore: Elsevier; 2002. p.1-2, 39-46, 93-7).[1]

The force acting on the anchor gear tends to move the anchor gear. In certain circumstances, for example, if the space available for tooth extraction is greater than the place needed to flatten the teeth, the slight movement of the anchor teeth is still acceptable. In general, care must be planned so that the movement of anchor teeth can be limited. If there were not enough intraoral anchors, extraoral anchorage can be added if space is needed. Fig.5 shows to move tooth 12 into the palatal of the anchor tooth moving only slightly (A). During retraction 13 and 23 anchor teeth move somewhat (B). When 15,14,24,25 are retracted together anchor teeth move very much (C).[9]

Figure 5 The need for the anchor to move the teeth. The more teeth that are moved the more likely the anchor teeth are moving (Source: Isaacson KG, Muir JD, Reed RT. Removable orthodontic appliances. Singapore: Elsevier; 2002. p. 1-2, 39-46, 93-7).[1]

Extra oral anchorage

When the entire extraction space is used for correction of the anterior teeth it is necessary to use extra oral reinforced anchorage when retracting the maxillary teeth, both canines and incisors. Extraoral anchorage is also used to move the posterior teeth distally depending on the strength used. [9]

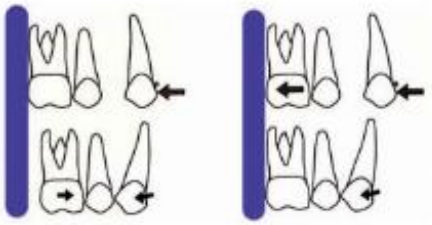

Figure 6A Without extraoral anchorage, the anchor tooth shifts to mesial, **B** with the addition of extraoral anchorage, the anchor tooth does not shift to mesial (Source: Isaacson KG, Muir JD, Reed RT. Removable orthodontic appliances. Singapore: Elsevier; 2002. p.1-2, 39-46, 93-7).[1]

The extra oral appliance consists of the headgear and facebow or J hook which transmits force from the headgear to the removable appliance in the mouth. The active component contained in the headgear is elastic which connects the headgear and facebow.

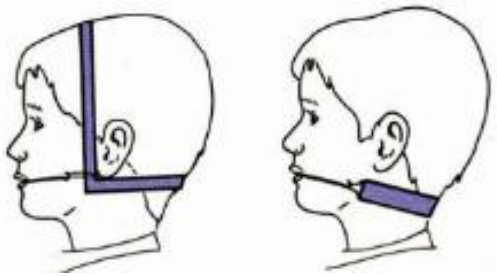

Figure 7A *Headcap*, **B** *neck strap* (Source: Isaacson KG, Muir JD, Reed RT. Removable orthodontic appliances. Singapore: Elsevier; 2002. p.1-2, 39-46, 93-7).[1]

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Extra-oral anchorage can be used to strengthen intra-oral anchorage, but can also be a major source of anchoring, for example in buccal segment retraction. The extra oral force depends on the elasticity of the connecting elastic found in the headgear. Extra oral anchorage can be obtained by using headgear, a bus in the form of headcap or high pull headgear. The link between the headgear and the removable appliance is the facebow or 'J' hooks.[1,6]

Headgear

Headgear used is the type of headcap or high pull headgear. When installing the headcap, the height of the elastic linkage can be adjusted to produce desired direction of force. The direction of traction must be horizontal as occipital anchorage or it can be made slightly higher to increase retention. The downward force component must be avoided because it causes the dislodged appliance to tend to lose.[1] The connection between the headgear and the removable appliance can use a face bow or 'J' hook with an extra oral traction appliance. The facebow is mounted in a tube which is soldered at the top of the bridge in the premolar or molar teeth.

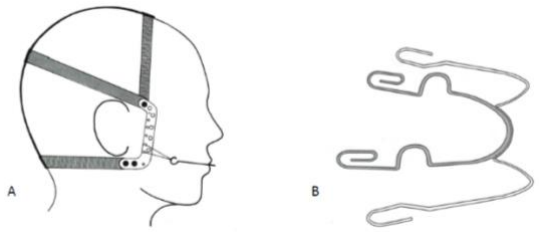

Figure 8 Extra oral anchorage; **A** in the use of headgear, the elastic height can be adjusted, **B** facebow connects the head-cap with the removable appliance in the mouth (Source: Isaacson KG, Muir JD, Reed RT. Removable ortho-dontic appliances. Singapore: Elsevier; 2002. p.1-2, 39-46, 93-7).[1]

Facebow

Although facebow is sold in the market with varying sizes, at the time of installation it must be adjusted again so that it is easily inserted into the tube. Bands can also be used to install a facebow tube as well as a graft from a removable appliance, but the graft used is not Adam but a flyover graft. Inner bow must be in accordance with the shape and length of the dental arch. The inner bow is placed several millimeters from the incisors and is as high as the active lip line. During treatment, the 'U' loop may need to be adjusted again to adjust the length of the inner bow. The outer bow is as close as possible to the lips and cheeks but does not touch, the location of the hook for elastic hooks is as high as the mesial surface of the first molar, about 4 cm in front of the hook from the headcap. When the headgear is used together with fixed appliance, the height and length of the outer bow determine the force vector applied to the teeth and affect the motion produced, but the attachment to the removable appliance is only so that the direction of the pull does not result in the appliance easily detaching.[1]

Figure 9 Facebow. The tip of the inner arc (**A**) enters the tube which is soldered to the Adams' bridge in the molar. The outer arc tip (**B**) is connected to the headgear (**C**) (Source: Rahardjo P. Peranti ortodonti lepasan. Surabaya: Airlangga University Press; 2009.p.44-53).[9]

J hook

The 'J' hook is an alternative link between extra oral traction appliance and the removable appliance. This appliance is soldered to the implant located on the incisor or upper canine. In fixed care treatments, the 'J' hook is used for intrusion of the upper labial segment, but for treatment with removable appliance the results are unknown (Fig.10).[1,6]

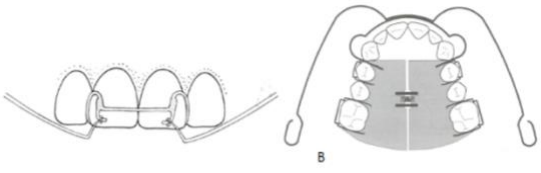

Figure 10 Extra oral anchorage using the 'J' hook and extra oral traction appliance. **A** 'J' hook is imprinted on the anterior graft, **B** the maxillary removable appliance is combined with extraoral traction apparatus for buccal retraction (Source: Isaacson KG, Muir JD, Reed RT. Removable ortho-dontic appliances. Singapore: Elsevier; 2002. p.1-2, 39-46, 93-7).[1]

Elastic tension is needed to balance the forces that arise when the force of the active component is applied. The amount of force used on each side for anchoring amplifiers ranging 150-200 g and for buccal segment 400-500 g. Force can be measured using a tension gauge or correx spring gauge. If the initial period of treatment with an oral extra appliance as an anchor amplifier has been completed, its use can be reduced to night only, ie during sleep. If anchorage loss is not expected, head-gear is used for 10-12 hours per day. For active buccal segment retraction, use for 12-14 hours per day.[1,6]

When demonstrating how to install extraoral appli-ance to the patient and parents, it must be explained that the facebow or extra oral traction appliance may be biased out of the mouth. This situation can occur if at the time of removing the facebow, the elastic link is still attached to the headcap, usually because the patient forgets or sometimes is released while playing.[1,6]

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The target time for using headgear should be achieved in stages. During the first two weeks, patients are usually asked to wear headgear in the afternoon. If the patient can get through it well, it is recommended to increase the time of use, namely during sleep. Headgear should be checked at each visit and the patient should be asked if during the appliance has been removed. The cause of the appliance must be sought and resolved immediately, otherwise the patient will not use the appliance while sleeping. Information regarding the adjustment and examination of headgear at each visit must be recorded in the patient's medical record.[1]

Factors that affect anchorage

Several conditions affect anchorage, namely the root surface area of the anchor tooth, the strength used and the tendency for mesial shift of the tooth.[9]

If the root surface area of the anchor tooth is the same as the teeth which are moved by these two groups will be equally moving. Efforts should be made to increase the tooth root surface area to be larger than the tooth that is moved so that the movement of anchor teeth is as minimal as possible. This can be performed by only moving one tooth each quadrant and involving as many anchor teeth as possible. For example, to correct protrusion in the case of class II division 1, the canine can be retracted first to the desired location, then incisor retracted while molars and premolars are used as anchors. Thus it can be expected that at each stage, the number of anchor teeth and the overall root surface area is greater than the tooth moved.[9]

Each tooth has a threshold value for strength to be able to move. If the teeth are given strength below this value, the teeth will move very little. With light strength as planned to move the teeth, the strength of these teeth will also be transmitted to anchor teeth which have a larger root surface area. This strength is still below the threshold value of the movement of the anchor teeth so that the anchor teeth do not move. But if the strength given is large enough and exceeds the threshold value of the movement of the anchor teeth, the anchor teeth will also move.[9]

Keep in mind the tendency of the teeth to shift to mesial. Therefore, it must be carefully considered if there is a mesial force acting on the anchor teeth. For example, in canine retraction there is an action to move the canine distally and there is a mesial force or retraction acting on the anchor teeth.[9]

Planning anchoring on removable appliance

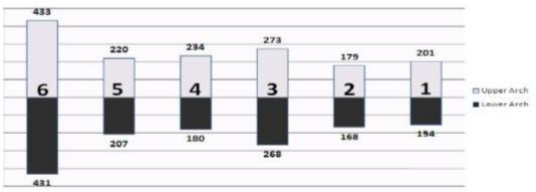
Breeding can be produced intra orally, extra orally, or both. Extra-oral anchorage has a great potential for success when used in cooperative patients, but the appearance of the appliance is disliked by the patient and uncomfortable when used. Intra oral anchorage is more acceptable to patients, but the ability to anchor it is very limited.[7] Breeding will be better if prepared early than when anchorage loss has occurred. If extra-oral anchorage is used since the beginning of treatment, it should be assessed whether the patient is able to comply with the time of use, before the next stage of the treatment is resumed. If in doubt of the anchorage value generated, the anchorage value must be evaluated at each visit. Operators must always pay attention to the movement of teeth that occur and compare it with the situation before treatment.[7]

In practice, it is very difficult to determine anchor values accurately. The basic things taken into consideration in determining anchoring values are the amount of force used, the pressure applied to the periodontal membrane, the root morphology, the available space, and the structure of the tissue around the teeth.[7]

Calculate the amount of force for a tooth or group of teeth; optimum pressure is the pressure that can produce tooth movement as far as possible with the risk to the tooth supporting tissue as small as possible. The optimum force is identical to the optimum pressure multiplied by the surface area of the root of the tooth to be moved. This is the rationale for the first concept of anchorage, namely that teeth or groups of teeth with a large root surface area have a greater anchor value than teeth or groups of teeth with a small root surface area. But the most important thing is not how much force should be applied to the teeth but what is the optimum pressure received by the periodontal ligament. In managing anchoring, to maintain the position of a tooth or group of teeth that are not expected to move, the pressure per unit surface area in the area must be small. Meanwhile, the tooth or group of teeth to be moved must accept the force within the optimum limit.[2,7]

The anchorage value of a tooth is identical to its root surface area.[2] But to determine the root surface area of each tooth is definitely very difficult. Table 1 can be used as a reference to estimate what the average root surface area of each tooth is, but of course this value is different for some circumstances, for example if alveolar bone resorption occurs and root shortening results in the root surface area decreasing.[2,7]

Table 1 Surface area of tooth roots is proportional to anchorage value.[7]



If force exceeds the optimal force, undermining resorption will occur, clinically irregular and slow tooth

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movement. In these circumstances it is not wise if the force is added because it can damage the supporting structures that are more severe and cause pain.[2,7]

Pressure distribution on the periodontal membrane based on the type of movement; the anchor value is strongly influenced by the distribution of pressure over the periodontal ligament. The pressure distribution is determined by the complexity of the applied force, for example whether a single or a pair of forces. The second principle of anchorage is that teeth which are free to move by tipping have smaller anchor value compared to teeth which are given a pairing force.[7] Proffit recommends a different optimum force for each movement.[2]

Root morphology affects anchorage; tooth root morphology determines the distribution of forces on the periodontal ligament, thereby affecting its anchorage value. One example is the mesiodistal root shape of the lower incisor teeth which is narrower than buccolingual, so that it has less resistance to proclination and retroclination movements than movements along curved lines.[7]

Calculates anchorage value based on available space; in the case of crammed teeth that require extraction, the anchorage value depends on how much the anchor teeth may move to fill the extraction chamber without using the space needed to repair crammed teeth. Breeding can be maximum, moderate, or minimum (Fig.6). It must be taken into account that after extraction, even without a tooth the buccal segment tends to shift mesially.[7,10,12]

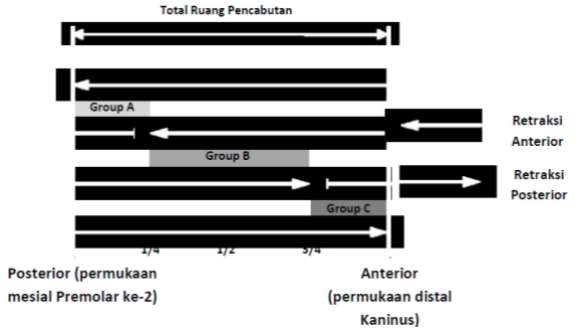

Figure 12 Classification of anchorage based on availability of retraction chamber. Group A or maximum anchorage if 100% room for anterior retraction (no posterior anchorage loss) to 75% anterior retraction (25% closure by posterior segment). Group B or moderate anchorage where the closure of the room by the anterior and posterior segments is equal. Group C or minimum anchorage where 75% to 100% of room closure is by the posterior segment (Source: Nanda R. Biomechanics in clinical orthodontic. Philadelphia: W.B. Saunders Co.; 1997. p.156-87).[10]

Structure in the surrounding area and anchorage value; the quality of the bone around the root determines the anchorage value of a tooth. Teeth are easier to move or require a smaller force if the supporting bone is cancellous. If the roots come in contact with cortical bone, the movement will slow down. If this happens, the amount of force should not be added.[7] Contiguous teeth, both erupted and unerupted, can add anchorage value. Alveolar bone deficiency, for example after extraction, can reduce the anchor value of adjacent teeth. Post-extraction alveoli with a large trauma will experience narrowing and cause dense bone area so that the movement of teeth to fill the area becomes difficult. Theoretically, the forces originating from the soft tissue around the mouth although small can affect anchorage value. The fixed jaw fixed appliance, combined with the lip bumper, utilizes the anchoring produced by the pressure of the lower lip to prevent the molar teeth moving forward. Palatal arcs plus acrylic buttons placed on the anterior grooves of the palate, can add anchor values for molar from forward movement. Tooth ankylosis and implant screw can also add anchorage value. [7]

Management of anchorage

Management of anchorage is basically adding anchoring until the value is sufficient to withstand unexpected tooth movement. In different cases, and at different treatment stages, the anchoring required can vary. The resistance of one group of teeth must be adjusted to another group so that at the end of the treatment the tooth position is expected to be achieved.[2] Efforts to manage anchoring are keeping the force light and increase anchor resistance.

Movement that can be produced by the removable appliance is tipping. The force required for tipping is relatively small, and so is the reaction force it creates. Reaction forces can be reduced by limiting the number of teeth moved. At each visit, only one tooth can be moved per quadrant in the same direction, and if it is retracting the anterior segment to reduce overjet, no other tooth should be moved in the palatal or distal direction. But it cannot be assumed that if light force is used it will be free of anchorage loss.[4]

The resistance produced by the accuracy of contact between the base plate and the tooth and mucosal surfaces influences the anchorage produced by the removable appliance. Anchoring can be maximized by keeping the acrylic surface in contact with as many teeth as possible.[4]

The cusp relationship that locks between the maxillary teeth and the lower jaw can add resistance to anchorage loss. The problem is, the removal of the two opposite jaws can cause the teeth to move together to the mesial in a state that remains locked. This possibility can be avoided if using a bite plane. The addition of the inclined bite plane to the maxillary plate can increase anchoring by channeling the thrust caused by the incisors of the lower jaw during occlusion. But it is not im-

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possible the addition of an inclined bite plane can result in the inclination of an incisor. Therefore, to reduce overbite it is better to use a flat bite plane.

Intermaxillary traction is rarely applied to the use of removable appliance. Maybe it can be used in the upper jaw to support the fixed appliance in the lower jaw, but it's still better if it is used in treatment with fixed appliances in both jaws. Extra oral traction is the most possible method for adding anchorage to removable appliance. The use of extra oral traction appliance is acceptable to patients and can expand the scope of removable appliance cases.[1,4,6]

It can be concluded that active removable appliance can be used effectively to treat certain cases of malocclusion. One thing that must be considered when planning treatment using removable appliance is to calculate the anchorage value. Breeding in removable appliance can be obtained intra orally, namely intramaxillary and intermaxillary, extra oral anchorage, or a combination of both. Factors that must be considered in planning anchoring are how much force is generated, how much pressure is received by the periodontal membrane, how is the morphology of the roots, how much space is available, and how is the structure of the tissue around the tooth to be moved or around sources that can be used anchor. Basically, anchoring management aims to keep the force used light and increase anchoring resistance, so that the gear that is expected to move while the teeth that are not expected to move can be held or minimized. During treatment, anchorage loss must be detected immediately, the cause searched, and dealt with as soon as possible so that no more severe errors occur so that the treatment results can be as good as possible.

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