An Orthodontic Appliance For Treating Malocclusion And A Method Using The Same

Technical Field

The present disclosure relates to an orthodontic appliance or a set of orthodontic appliances applicable for treatment of malocclusion. More particularly, the disclosed appliance can be used to treat malocclusion caused by extraction space present in at least one of dental arches of a subject. The present disclosure also involves method of correcting malocclusion using the disclosed appliance.

Background

Malocclusion is a common finding arisen from incorrect relation or alignment between teeth of the two dental arches in a human subject. Setting aside aesthetic reason, other orthodontic or clinical complications such as increased susceptibility to caries and plaque can generally spring from malocclusion too. Orthodontic appliances like bracers or aligners are widely used to treat malocclusion though surgical procedures including tooth extraction may be resorted in some cases. Bracers in the form of metal wires or coils are considered conventional tool in correcting malocclusion. It comprises a set of multiple bracers to be sequentially affixed to the dental arches of the subject for a period of time. Each bracer in the set carries configuration slightly different from the earlier affixed counterpart to consistently generate a pulling and/or pushing force thereby to gradually move or re-align the teeth on the arches. The teeth repositioning or realignment only stops when the subject finally acquires normal or complete occlusion. Examples of orthodontic bracers can be found in United States patent application no. 1638006, 2481177, and 3092907. Despite offering satisfactory outcome, each session of bracer replacement in the treatment course is laborious and time consuming for both subject and the responsible dentist. Moreover, the metal wires fastened on the teeth, throughout the treatment can be sometimes unsightly. Consequently, aligners fabricated from resiliently deformable polymer are developed in recent years to not only correcting malocclusion but also addressing some of the aforesaid shortcomings faced by the use of metal bracers. In comparison, aligners are set of plastic trays to be put onto the teeth in succession like bracers to effectuate incremental changes of the teeth position, but being designed in a conveniently removable manner. Aligners are preferably made of transparent plastic material to minimize adverse impact to the natural outlook of the teeth when it is in

use. The flexibility of being self-removable and self-changeable by the user of aligners saves subject from multiple visits to dental clinic in contrast to conventional bracers requiring professional service in replacement of an earlier affixed bracer. Use of aligner also greatly improves oral hygiene of the subject as the aligner can be removed and cleaned from time to time. Detailed disclosure with respect to orthodontic aligners can be found in United States patent application no. 5975893 and 6450807, which are assigned to Align Technology Incorporated. Other aligner designs with enhanced features are United States patent publication no. 2013/0157213 disclosing aligner incorporated with at least one retention clip to improve attachment to the dental arch and United States patent publication no. 2013/0209952 detailing a hybrid form of aligner having bracer-like bracket receiving portion.

Aligners are effective means to treat malocclusion types requiring only repositioning of teeth over a relatively small distance of 1 to 3 mm on the dental arch. It is not suitable for malocclusion treatment involving closure of relatively large space. As being alluded earlier, dentists may need to extract one or more teeth on a dental arch so that sufficient space becomes available for subsequent tooth repositioning. In the absence of rigid support at the extraction site, effort to close large extraction space using typical aligners to restore normal occlusion is likely to fail. Specifically, initial engagement of the employed aligners onto the dental arches tends to urge the tooth adjacent to the extraction site to tip towards the extraction space rather than moving the tooth entirely. Such undesired inclination inevitable widen the aligner at the gingival level. Moreover, the level of tipping or inclination turns worse following successive engagement of new aligner pushing the teeth to lean further. The tipping or distortion at some point can become irreversible. McCance set out in United States patent publication no. 2011/0311937 to prevent unwanted tipping during the space closure. The aligner of McCance includes a posterior component slidably connecting to an anterior component. The posterior component has a support block and a clasp member provided thereto to act against tipping of the tooth adjacent to the extraction site while a pulling force and a pushing force are exerted simultaneously to the adjacent teeth via two spring coils. Nevertheless, appliance of McCane can be difficult to use in daily practice. Particularly, users may themselves fumbling within limited space of the oral cavity to adjust and slide the posterior component against the two coil springs, with unsuccessful attempts to affix the posterior component onto the dental arch. Therefore, aligner or other tooth repositioning

means capable of delivering the like result yet operable based upon much simplified and user-friendly mechanism are greatly desired.

Summary

One object of the present disclosure aims to provide an orthodontic appliance or a set of orthodontic appliances to correct or at least alleviate dental malocclusion in a subject.

Another object of the present disclosure is to provide an orthodontic appliance capable of restoring occlusion by repositioning teeth on a dental arch of the subject. Particularly, the disclosed appliance can incrementally move one or more teeth along the dental arch to position and align the teeth to the correct order as part of a treatment for malocclusion.

Still another object of the present disclosure is to offer an orthodontic appliance for bringing at least one tooth, adjacent to an extraction site, nearer to the extraction site for closing the extraction space thereto without substantially tilting or tipping the repositioned tooth. The disclosed appliance is applicable as well for correcting intrusion and/or extrusion of teeth through incremental adjustment about tipping angle of an extruded or intruded tooth.

Further object of the present disclosure directs to a method of using the set of disclosed orthodontic appliances to facilitate incremental extraction space closure on the dental arch for at least alleviating malocclusion in a subject.

At least one of the preceding objects is met, in whole or in part, by the present invention, in which one of the embodiments of the present invention is an orthodontic appliance for closing a space present in between a first tooth and a second tooth, which are respectively located at a first segment and a second segment of a dental arch of a subject. Preferably, the appliance comprises a tray having a first component and a second component being separated apart by a gap substantially corresponding to the space to be closed, the first and second components respectively defining cavities conforming outer shapes of the teeth of the first segment and the second segment, the first and second components being respectively securable onto the first and second segments with each component having one lateral wall forming a sac structure wrapping onto lateral side of the first or second tooth; and a

polymeric elastomer connector interposing between the first and second components of the tray. Preferably, the elastomer connector is configured to exert a continual force to effect repositioning of the first tooth and/or the second tooth in closing the space present therebetween, and the sac structures are machined to act against tipping of the first tooth and/or the second tooth during the repositioning.

In a number of embodiments, the disclosed appliance further comprises a sheath at the buccal side of the tray extending from one of the sac structures towards another sac structure to visibly shield the space in such fashion that the sheath is not directly joined to another sac structure. More preferably, the sheath is fabricated to resemble outer shape of the buccal surface of a tooth.

For several embodiments, the sac structures are structurally reinforced to act against tipping of the first tooth and/or the second tooth along the repositioning. Addition ribs or the like configurations can be fabricated thereon to act against potential tipping or tilting of the tooth.

In order to bringing the two teeth adjacent to the extraction site closed to one another to close the extraction space, the gap of the appliance preferably has width smaller in relation to the width of the extraction space in some embodiments.

For a few embodiments, the elastomer connector is a resilient piece concaved towards lingual side of the dental arch.

In several other embodiments, the tray and the elastomer connector are an integral structure made of polymeric material. More preferably, the appliance, as an integral structure, is free from any metal or alloy material.

Another aspect of the present disclosure refers to a method for closing an extraction space present in between a first tooth and a second tooth, which are respectively located at a first segment and a second segment of a dental arch of a subject. The disclosed method preferably comprises the steps of providing a plurality of orthodontic aligners to be sequentially worn by the subject to progressively reduce the extraction space, each aligner being configured to be

worn for a predetermined period to complete one treatment session, the plurality of orthodontic aligners comprising an initial aligner and a succeeding aligner to be worn pursuant to complete of the treatment session of the initial aligner. Accordingly, each of the orthodontic aligners comprises a tray having a first component and a second component separated apart by a gap substantially corresponding to the space to be closed, the first and second components respectively defining cavities conforming outer shapes of the teeth of the first segment and the second segment, the first and second components being respectively securable onto the first and second segments with each component has one lateral wall forming a sac structure wrapping onto lateral side of the first or second tooth; anda polymeric elastomer connector of predetermined length interposing between the first and second components at the lingual side of the tray, the connector joining to the first and second components respectively at a first attachment point and a second attachment point. The the elastomer connector is configured to exert a continual pulling force to perform repositioning the first tooth and/or the second tooth in closing the space present therebetween, and the sac structures are machined to act against tipping of the first tooth and/or the second tooth along the repositioning. Preferably, the gap of the succeeding aligner is smaller in relation to the initial aligner.

According to some preferred embodiments of the disclosed method, the first and second attachment points of the succeeding aligner are located further away from the sac structures than the first and second attachment points of the initial aligner.

In a number of embodiments of the disclosed method, the predetermined lengths of the elastomer connector of the initial and succeeding aligners are substantially similar by way of locating the first and second attachment points of the succeeding aligner further away from the sac structures in relation to the first and second attachment points of the initial aligner.

In other embodiments of the disclosed method, the predetermined length of the elastomer connector of the succeeding aligner is substantially equal to the predetermined length of the elastomer connector of the initial aligner by way of extending the elastomer connector of the succeeding aligner towards lingual

In accordance with some preferred embodiments, the disclosed method has at least one of the initial and succeeding aligners further comprised a sheath at the buccal side of the tray extending from one of the sac structures towards another sac structure to visibly shield the space that the sheath is not directly joined to another sac structure.

Brief Description of Drawings

FIG.1 illustrates back perspective view of one embodiment of the disclosed appliance in the form of aligner;

FIG.2 shows another perspective view of the embodiment present in FIG.1;

FIG.3 shows side perspective view of the embodiment present in FIG.1 in which the outlook of the sheath corresponds to a real tooth when being viewed at this angle; and

FIG.4 presents top of view of the appliance shown in FIG.1.

Detailed Description

Hereinafter, the disclosure shall be described according to the preferred embodiments of the present invention and by referring to the accompanying description and drawings. However, it is to be understood that limiting the description to the preferred embodiments of the disclosure and to the drawings is merely to facilitate discussion of the present disclosure and it is envisioned that those skilled in the art may devise various modifications without departing from the scope of the appended claim.

As shown in FIG.1-FIG.4, one aspect of the present disclosure relates to an orthodontic appliance or a plurality of such appliance to be used for closing a space present in between a first tooth and a second tooth. The space defined in between the first tooth and second tooth is preferably a space of an extraction site. Correspondingly, the first tooth and the second tooth are separately located at a first segment and a second segment of a dental arch of a subject. The first segment, as described hereinafter in general, refers to a series or group of teeth which is more anteriorly positioned on the arch compared to the more posteriorly

positioned teeth at the second segment. Accordingly, the disclosed appliance comprises a tray 100 having a first component 110 and a second component 120 being separated apart by a gap 130 substantially corresponding to the space to be closed, and a polymeric elastomer connector 170 interposing between the first 110 and second components 120 at the lingual side of the tray 100. As illustrated in the appended FIG.1 -4, the appliance can be fabricated to have two second components 120 individually connecting one of opposite ends 113 of the first component 110 to effectuate closure of two extraction spaces simultaneously despite the subsequent description and discussion hereinafter generally are directed to closure of a single extraction space for brevity reason. Concurrent removal of a pair of symmetrically positioned teeth for malocclusion treatment is common practice in the field that one skilled artisan shall be aware that the idea or concept provided in the present disclosure can be used to reduce two extraction spaces almost symmetrically present on a dental arch.

Preferably, the first 110 and second components 120 respectively define cavities 117 conforming outer shapes of the teeth of the first segment and the second segment. The tray 100 including the first 110 and second components 120 can be constructed using dental impression model or stone model of the subject by firstly repositioning the teeth on the model to slightly reduce the extraction space, subsequently forming the elastomer connector 170 inwardly curved or concaved towards the lingual side of the extraction site present on the model, and vacuum forming the appliance using compatible thermoplastic. Alternatively, the disclosed appliance can be manufactured by digitally scanning the original dental impression model, modifying the tooth position in a digital template using a CAD/CAM program, adding in the connector 170 digitally to the modified template, and finally fabricating the appliance from the modified template via 3D printing or vacuum forming. The thermoplastic material applicable for construction of the disclosed appliance can be polymer or derivatives copolymer of polyethylene terephthalate (PETG), polycarbonate, polyurethane and/or any combination derived thereof. By fitting the teeth into the cavities 117 of the corresponding components 110/120, the first 110 and second components 120 can be respectively securable onto and enclose the first and second segments of the dental arch on which the extraction space to be closed is found. Particularly, each component has one lateral wall forming a sac structure 160 at the end directed towards the extraction space. The sac structures 160 wrap onto lateral side of the first or second tooth and are machined to impart necessary structural

stiffness or rigidity to act against tipping of the first tooth and/or the second tooth when the teeth are subjected to gradual repositioning. Owing to the fact that the gap 130 between the first 110 and second components 120 has width smaller in relation to the width of the extraction space, the elastomer connector 170 in the appliance has to be stretched in order to fit the components 110/120 onto the corresponding segment. The stretched elastomer connector 170 is under constant tension force to contract for resuming its original state. As such, the elastomer connector 170 of the present disclosure is configured to exert a continual force to effect repositioning of the first tooth and/or the second tooth in closing the space present therebetween upon fitting the tray 100 onto the dental arch to be treated. The exerted force progressively moves the first tooth and second tooth towards one and other to gradually reduce the extraction space until finally attaining normal occlusion by end of the treatment. The elastomer connector 170 preferably has a thickness of 0.8 to 1.6 mm and length of 10 to 20 mm.

In some of the preferred embodiments, the disclosed appliance is free from any metal or alloy material. The use of elastomer connector 170 in the disclosed appliance allows the fabricated aligners to be wholly made of thermoplastic, or possibly thermosetting, biocompatible polymer free from any aid or need of using wires, springs or clips made of metal or alloy. Such embodiments of disclosed appliance can be conveniently 3D-printed under single step automation by the dental profession. In more embodiments, the tray 100 and the elastomer connector 170 are an integral structure made of similar elastomeric polymer or polymeric material.

Still, in other embodiments, the elastomer connector 170 and the components of the tray 100 are composed of different polymer or resins. For instance, the connector 170 may be a product of polymer capable of offering sustained tension and pulling force for space closure, while the components of the tray 100 are manufactured from highly pliable plastic to snugly secure onto the dental arches. As mentioned above, the disclosed appliance of the like embodiments can be prepared by firstly manufacturing the connector 170 using a first polymer then further constructing the components using second polymer onto the connector 170. Preferably, the connector 170 joins to the first 110 and second components 120 respectively at a first attachment point 118 and a second attachment point 119. As illustrated

in FIG.1 and 4, the elastomer connector 170 is a resilient piece concaved or curved towards lingual side of the dental arch giving a substantial C- or U-shaped planar cross-section. The concaved or curved configuration of the connector 170 leads to greater flexibility in fitting the connecting components to the dental arch yet generates enough continual force to reposition the teeth.

The present disclosure can possibly position the elastomer connector 170 at the labial side of the tray 100 in few embodiments of the disclosed appliance. These embodiments are specifically fabricated for correcting other orthodontic related complications such as tooth intrusion in addition to space closure. By managing position of the first 118 and second attachment points 119 on tray 100, the present disclosure can customarily decide location of the force exerted thereof by the connector 170. Thus, the disclosed appliance of such embodiments can impose incremental correction towards a specific point, particularly where an intruded or extruded tooth located, on the enclosed segment. The combined use of the dental components 110/120 and the elastomeric connector 170, which can be adaptably attached to various locations or points on the components 110/120 to generate a correcting force thereto, has significantly expand applications of the present disclosure in treating different orthodontic conditions besides space closure.

Also, the sac structures 160 of the disclosed appliance in a number of embodiments may be structurally reinforced to work against tipping of the first tooth and/or the second tooth during the repositioning process. One or more ribs, which can be either horizontally- or vertically-oriented, are placed on the external surface of the sac structure 160 to enhance hardiness thereto against the tipping and/or tilting of the first tooth and/or second tooth. During the teeth repositioning, the sac structure 160 optionally with the fabricated ribs prevents the first and/or second tooth from tipping then wedging the aligner open in the presence of the tooth correcting force. The rigid sac structure 160 in the present disclosure makes sure the tooth in repositioning process traverse along the dental arch as a whole rather than partially tipping into the extraction space.

Pursuant to several preferred embodiments, the disclosed appliance comprises a sheath 210 at the buccal or labial side of the tray 100 extending from one of the sac structures 160 of one

component 110/120 towards sac structure 160 of another component 120/110 to visibly shield the extraction space or gap 130 in such fashion that the sheath 210 does not directly join to sac structure 160 of another component. Preferably, the extending sheath 210 is fabricated to resemble outer buccal surface of a tooth, more preferably the outer appearance of the extracted tooth. Visibly concealing the extraction site or space using the sheath 210 in the present disclosure brings forth aesthetic improvement in addition to the functional endeavor for malocclusion correction. Such arraignment is important in preserving self-image of the subject especially at the initial stage of space closure where the extraction site is still visibly apparent and unsightly. In accordance with some embodiments, the sheath 210 extends from the sac structure 160 of the first component 110 to the sac structure 160 of the second component 120 creating a lateral pending end 211 adjacent to second component 120. More preferably, the present disclosure has the pending end 211 of the sheath 210 folded or looped backward presenting a 3-dimensional impression to a viewer when it is worn by the subject. In several embodiments, the sheath may be in a color different from the rest of the tray 100. For example, the rest of the tray 100 can be transparent and the sheath 210 is white in color to visibly conceal the extraction site in resemblance of the extracted tooth. Further, the end of sheath 210 is deliberately left hanging without physically attaching to the second component 120 such that the connector 170 can remain flexibly stretchable to secure the tray 100 onto the dental arch easily. Other embodiments of the disclosed appliance especially those to be used in later stage of the space closure are likely not to have the sheath 2210 considering the extraction space has been substantially reduced by then.

Another aspect of the present disclosure includes a method for closing an extraction space present in between a first tooth and a second tooth, which are respectively located at a first segment and a second segment of a dental arch of a subject. The disclosed method preferably comprises the steps of providing a plurality of orthodontic aligners to be sequentially worn by the subject to progressively reduce the extraction space that each aligner is configured to be worn for a predetermined period to complete one treatment session. Preferably, the gap 130 of the succeeding aligner is smaller in relation to the initial aligner. The plurality of orthodontic aligners implemented in the disclosed method at least comprises an initial aligner and a succeeding aligner, which is worn pursuant to complete of the treatment session of the initial aligner. It is important to note that the aligners used in the set of the disclosed method

is generally more than two, more preferably 3 to 6. The initial aligner described throughout this specification commonly refers to any aligner being used to attain a treatment session prior to the use of a succeeding aligner, that the initial aligner can be first, second, third, fourth or etc. in the given set to be worn but not last. Conversely, the succeeding aligner refers to any aligner being used to attain a treatment session after the use of the initial aligner. The succeeding aligner can be second, third, fourth or etc. in the given set to be worn but not the first aligner to be used.

The orthodontic aligners used in the disclosed method generally include most of the features setting forth in the above disclosed appliance. Particularly, each aligner comprises a tray 100 having a first component 110 and a second component 120 separated apart by a gap 130 substantially corresponding to the space to be closed; and a polymeric elastomer connector 170 of a predetermined length interposing between the first 110 and second components 120 at the lingual side of the tray 100. Further, the first 110 and second components 120 define cavities 117 conforming outer shapes of the teeth of the first segment and the second segment so that the first 110 and second components 120 can be respectively securable onto the first and second segments. Each component 110/120 of the aligner used in the disclosed method has one lateral wall forming a sac structure 160 wrapping onto lateral side of the first or second tooth. Preferably, the connector 170 of the present disclosure joins to the first 110 and second components 120 separately at a first attachment point 118 and a second attachment point 119. The elastomer connector 170 in the disclosed method is configured to exert a continual pulling force to perform repositioning the first tooth and/or the second tooth in closing the space present therebetween, while the sac structures 160 are machined to act against tipping of the first tooth and/or the second tooth during the repositioning.

For a number of embodiments, disclosed method requires the elastomer connector 170 to be modified in each sequentially worn aligner in association to incremental reduction of the extraction site. In more specific, the connector 170 in each aligner of the set of aligners is slightly tweaked according to the progress of the space closure in order to finally correct the malocclusion. The modification is directed to ascertain that the force generated by the connector 170 throughout the set of aligner is adequate to reposition the teeth at a desired rate especially when the extraction site or space becomes reduced. Preferably, the disclosed

method maintains length of the elastomer connector 170 within a predetermined range across the set of aligners to uphold the minimal required force facilitating the space closure. In a few embodiments, the disclosed method has the first 118 and second attachment points 119 of the succeeding aligner located further away from the sac structures 160 than the first 118 and second attachment points 119 of the initial aligner to maintain predetermined length of the connector 170. By moving the attachment points sequentially away from the sac structure 160, the disclosed method can retain length of the connector 170 within a preferred range. In short, the predetermined lengths of the elastomer connector 170 of the initial and succeeding aligners are substantially similar by way of locating the first 118 and second attachment points 119 of the succeeding aligner further away from the sac structures 160 in relation to the first 118 and second attachment points 119 of the initial aligner.

In other embodiments, the predetermined length of the elastomer connector 170 of the succeeding aligner is substantially equal to the predetermined length of the elastomer connector 170 of the initial aligner by way of extending the elastomer connector 170 of the succeeding aligner further inwardly or towards the lingual side in connection to smaller gap, compared to initial aligner, in between the components of the succeeding aligner. The further inward extension of the connector 170 to the lingual side featured in the succeeding aligner ensures that length of constructed connector 170 is substantially equal to the one found in the initial aligner and the force exerted thereby can reposition teeth at a rate about similar to the initial aligner. Throughout the set of aligners employed in the disclosed method, the gap 130 between the first and second members preferably has width smaller in relation to the width of the space in the extraction side, such that the connector 170 always stretches into tension in connection to fitting of the members onto the dental arch.

In several preferred embodiments, the disclosed method has at least one of the initial and succeeding aligners further comprised a sheath at the buccal side of the tray 100 extending from one of the sac structures towards another sac structure to visibly shield the space that the sheath is not directly joined to another sac structure. Preferably, the extending sheath is fabricated to resemble outer shape of the buccal surface of a tooth, more preferably the outer appearance of the extracted tooth. In some embodiments, the sheath bearing outer appearance of the extracted tooth is only made available in the initial aligner but not the succeeding

aligner. The sheath 210 can be omitted in the succeeding aligners once the extraction side has been substantially reduced by the initial aligner. As in the foregoing, the sheath 210 extends from the sac structure 160 of the first component 110 to the sac structure of the second component 120 creating a lateral pending end adjacent to second component 120. The sheath 210 of the aligner employed in the disclosed method has the pending end 211 folded or looped backward towards the lingual side to provide a 3-dimensional impression. In several embodiments, the sheath 210 may be in color different from the rest of the tray 100.

Aspects of particular embodiments of the present disclosure address at least one aspect, problem, limitation, and/or disadvantage associated with existing motorcycle side cover structures. While features, aspects, and/or advantages associated with certain embodiments have been described in the disclosure, other embodiments may also exhibit such features, aspects, and/or advantages, and not all embodiments need necessarily exhibit such features, aspects, and/or advantages to fall within the scope of the disclosure. It will be appreciated by a person of ordinary skill in the art that several of the above-disclosed structures, components, or alternatives thereof, can be desirably combined into alternative structures, components, and/or applications. In addition, various modifications, alterations, and/or improvements may be made to various embodiments that are disclosed by a person of ordinary skill in the art within the scope of the present disclosure, which is limited only by the following claims.

Claims

1. An orthodontic appliance for closing a space present in between a first tooth and a second tooth, which are respectively located at a first segment and a second segment of a dental arch of a subject, comprising:

a tray having a first component and a second component being separated apart by a gap substantially corresponding to the space to be closed, the first and second components respectively defining cavities conforming outer shapes of the teeth of the first segment and the second segment, the first and second components being respectively securable onto the first and second segments with each component having one lateral wall forming a sac structure wrapping onto lateral side of the first or second tooth; and

a polymeric elastomer connector interposing between the first and second components of the tray, wherein the elastomer connector is configured to exert a continual force to effect repositioning of the first tooth and/or the second tooth in closing the space present therebetween, and the sac structures are machined to act against tipping of the first tooth and/or the second tooth during the repositioning.

2. The orthodontic appliance of claim 1, further comprising a sheath at the buccal side of the tray extending from one of the sac structures towards another sac structure to visibly shield the space in such fashion that the sheath is not directly joined to another sac structure.

3. The orthodontic appliance of claim 2, wherein the sheath is fabricated to resemble outer shape of the buccal surface of a tooth.

4. The orthodontic appliance of claim 1, wherein the sac structures are structurally reinforced to act against tipping of the first tooth and/or the second tooth along the repositioning.

5. The orthodontic appliance of claim 1, wherein the gap has width smaller in relation to the width of the space.

6. The orthodontic appliance of claim 1, wherein the elastomer connector is a resilient piece concaved towards lingual side of the dental arch.

7. The orthodontic appliance of claim 1, wherein the tray and the elastomer connector are an integral structure made of polymeric material.

8. The orthodontic appliance of claim 1 is free from any metal or alloy material.

9. A method for closing an extraction space present in between a first tooth and a second tooth, which are respectively located at a first segment and a second segment of a dental arch of a subject, comprising:

providing a plurality of orthodontic aligners to be sequentially worn by the subject to progressively reduce the extraction space, each aligner being configured to be worn for a predetermined period to complete one treatment session, the plurality of orthodontic aligners comprising an initial aligner and a succeeding aligner to be worn pursuant to complete of the treatment session of the initial aligner, each of the orthodontic aligners comprising

a tray having a first component and a second component separated apart by a gap substantially corresponding to the space to be closed, the first and second components respectively defining cavities conforming outer shapes of the teeth of the first segment and the second segment, the first and second components being respectively securable onto the first and second segments with each component has one lateral wall forming a sac structure wrapping onto lateral side of the first or second tooth; and

a polymeric elastomer connector of predetermined length interposing between the first and second components at the lingual side of the tray, the connector joining to the first and second components respectively at a first attachment point and a second attachment point, wherein the elastomer connector is configured to exert a continual pulling force to perform repositioning the first tooth and/or the second tooth in closing the space present therebetween, and the sac structures are machined to act against tipping of the first tooth and/or the second tooth during the repositioning;

wherein the gap of the succeeding aligner is smaller in relation to the initial aligner.

10. The method of claim 9, wherein the first and second attachment points of the succeeding aligner are located further away from the sac structures than the first and second attachment points of the initial aligner.

11. The method of claim 9, wherein the predetermined lengths of the elastomer connector of the initial and succeeding aligners are substantially similar by way of locating the first and second attachment points of the succeeding aligner further away from the sac structures in relation to the first and second attachment points of the initial aligner.

12. The method of claim 9, wherein the predetermined length of the elastomer connector of the succeeding aligner is substantially equal to the predetermined length of the elastomer connector of the initial aligner by way of extending the elastomer connector of the succeeding aligner towards lingual side.

13. The method of claim 9, wherein at least one of the initial and succeeding aligners further comprises a sheath at the buccal side of the tray extending from one of the sac structures towards another sac structure to visibly shield the space that the sheath is not directly joined to another sac structure.

14. The method of claim 9, wherein the gap has width smaller in relation to the width of the space.