A magnetic mouthguard retention system affords athletes a unique way to fasten or attach an athletic mouthguard for easy and convenient retrieval. It encompasses the use of a magnetic force which is uniquely located in the palatal aspect of the mouthguard, along with a separate docking station which has the unique property of being both magnetic and elastic. Primarily, the docking station is placed on athletic accessories including, but not limited to, facemasks, wristbands, headbands, armbands, or other sports equipment and apparel.
MOUTHGUARD MAGNETIC RETENTION SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of provisional patent application Ser. No. 61/578,235 filed Dec. 21 by the present inventor.

BACKGROUND

Prior Art

[0002] The following is a tabulation of prior art that presently appears relevant:

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Patentee</th>
<th>Issue Date</th>
<th>Kind Code</th>
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<tr>
<td>257,038</td>
<td>McMann</td>
<td>April 1882</td>
<td>A</td>
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<tr>
<td>2,643,652</td>
<td>Cathcart</td>
<td>June 1953</td>
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<td>2,694,397</td>
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<tr>
<td>2,847,003</td>
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<td>2,966,908</td>
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<td>3,058,462</td>
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<td>3,124,129</td>
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<td>3,203,417</td>
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<td>3,312,218</td>
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<td>3,768,465</td>
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<td>4,491,941</td>
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<tr>
<td>4,977,905</td>
<td>Kittelsen et al.</td>
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<tr>
<td>5,339,832</td>
<td>Kittelsen et al.</td>
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<tr>
<td>5,826,581</td>
<td>Yoshida</td>
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<td>6,237,601</td>
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<td>Kittelsen et al.</td>
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<td>D663,486</td>
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<td>S</td>
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Dental injuries are the most common form of oral facial injuries in sports. Typical injuries include fractured teeth, subluxated teeth, avulsed teeth, jaw fracture, condylar fracture and joint dislocation. The majority of these injuries occur in, so called, non-contact sports where mouthguard wear is optional for the participant. The American Dental Association has actively taken steps to increase public awareness of the need for mouthguard wear in nearly all sports. Accordingly, this invention can be utilized in every sport or activity where the use of a mouthguard is recommended. This includes, but is not limited to, football, lacrosse, hockey, field hockey, rugby, basketball, volleyball, baseball, softball, soccer, skateboarding, cycling, wrestling, martial arts, and gymnastics. Unfortunately, most sports participants, with the exception of those required by rules, are reluctant to wear a mouthguard. There are perhaps several reasons for this. One major factor is that there has never been a reliable, convenient way for an athlete to keep a mouthguard in his or her possession once it is removed from the mouth, as is often necessary during time-outs or between plays—a problem that this invention helps remedy. While this dilemma has partially addressed in sports such as football, where a helmet strap has been incorporated into the design so that the mouthguard remains attached to a facemask via a strap or string, the fact remains that many athletes dislike having the mouthguard loosely swinging in front of them and choose instead to wear a strapless mouthguard. Accordingly, such participants are relegated to either holding the mouthguard in their hand or awkwardly trying to wedge it between bars of the facemask when it is not in the mouth—a practice that often results in permanent loss of the mouthguard. As for sports which do not utilize a facemask, players have had even fewer options and have had no reliable, convenient system or set-up for dealing with a mouthguard when it is not in the participant’s mouth. This particular invention solves this problem by using magnetic forces which are uniquely oriented to securely attach the mouthguard in a convenient manner. When removed from the mouth, it keeps the mouthguard securely in place, ready for insertion.

[0004] Marsh, in U.S. patent application Publication No. US 2011/0155146 A1, suggests the use of magnetic forces to releasably fasten a mouthpiece. In his design, the magnetic forces are arranged such that the mouthguard is retained perpendicular to a binding surface or uniform. My testing has shown that in such a perpendicular position, the mouthguard is easily dislodged, which is unacceptable as this usually results in permanent loss of the mouthguard. Furthermore, his design requires placing the magnet in peripheral sidewalls of the mouthguard, which can be dangerous to the user as this places the magnet in close proximity to the teeth where an offending blow will trap the magnet between the teeth and the offending force. This could easily result in injury to the teeth or supporting structures.

[0005] Wright, in U.S. patent application Publication No. US 2012/0285473 A1, suggests locating a magnet or magnets on the occlusal or biting surface of a mouthguard. This too is dangerous to the user since the magnets are located in close proximity to the tooth structure and a heavy blow to the chin would force the upper and lower teeth together. The magnet is then trapped between the upper and lower teeth which greatly increases the chance of damage to tooth structure. He suggests locating the magnet or magnets within a scaffolding system on the biting surface which increases the thickness of the mouthguard in the area where the incisor and molar regions. This increase in thickness in only these areas prevents an even distribution of force to the entire dental arch. The forces resulting from a blow to the chin are then concentrated to the area in which the magnets are located, further increasing the chance of injury. In addition, the idea of using a plurality of magnets in a mouthguard is undesirable since accidental swallowing of two or more magnets can result in attraction of the magnets within the gastrointestinal system. This is very dangerous as the delicate tissues of the intestinal tract can be trapped between two magnets, resulting in serious injury or even death. Since the users of mouthguards often chew on the peripheral parts, such a scenario is quite possible. However, if
only one magnet is incorporated into the mouthguard design, accidental swallowing is of no serious consequence. Wright also suggests using the outer layer facial flanges of a mouthguard for magnet location, similar to that suggested by Marsh above.

[0006] To enhance the magnetic retentive forces between a user’s facemask and a mouthguard, a clump system has been suggested. However, the previously proposed clump mechanisms are fixed, rigid systems. My experimentation has shown that a fixed, rigid system is not adequate to prevent accidental detachment of the mouthguard as a result of incidental contact such as a bump or a jar.

[0007] Besides the problem with increased susceptibility to injury due to magnet location and an increased likelihood of accidental detachment, previous designs also necessitate that the mouthguard be bulkier along peripheral sidewalls or occlusal surfaces in order to accommodate the magnet or magnets. This added thickness can have a negative impact on breathing or the ability to speak clearly, which is important for communication with teammates and coaches.

[0008] In addition, prior art suggests using magnets in the size range of 2-10 mm in length and 3-6 mm in width. These smaller sizes, which are necessary to fit the magnets within the contours of peripheral sidewalls or occlusal surfaces, do not, according to my testing, provide adequate retentive force to prevent accidental detachment and subsequent loss of the mouthguard.

SUMMARY

[0009] This invention is unique and an improvement over prior art in that it utilizes the palatal area of the mouthguard for location of the magnet. Prior art has suggested locating the magnet on peripheral sidewalls or occlusal surfaces. My novel, palatal placement of the magnet is an improvement over previous designs in that it reduces the possibility of injury to the teeth, gum structures, or lips from a heavy blow which can crush or trap the magnet between these delicate structures and the offending force. This novel, palatal placement of the magnet also allows the mouthguard to be less bulky in the labial and occlusal regions which is important for improved breathing and communication.

[0010] This invention is also unique in that a magnet is positioned palatally within a mouthguard such that the magnetic force retains the mouthguard parallel to a binding surface and facilitates a centrally located retentive force. Prior art locates the magnet and its resulting magnetic force peripherally, either on the peripheral sidewalls or on the occlusal surface. My experimentation has shown that this peripheral location of the magnetic force makes the mouthguard much more vulnerable to accidental detachment. My novel, palatal arrangement centers the magnetic force over the body of the mouthguard, which keeps the mouthguard more securely attached to the binding surface and reduces the possibility of accidental detachment.

[0011] Another advantage of locating the magnet in the palatal area is that this allows the use of a larger magnet. My testing has shown that this is an extremely important factor in the prevention of accidental detachment. Prior art suggests the use of magnets in the size range of 2-10 mm in length and 3-6 mm in width. These smaller sizes are used since the magnet’s location in peripheral sidewalls or occlusal surfaces restricts the surface area available for placement of the magnet. My experimentation has shown that these smaller sizes are not of sufficient strength to adequately retain the mouthguard, as the size and magnetic strength of magnets are proportional to one another. This invention utilizes the larger surface area of the palate, which is unique for this application, and allows for the use of magnets which are larger without being obstructive and provides for much improved retention.

[0012] This invention utilizes rare-earth magnets, primarily (but not limited to) neodymium-iron-boron, to generate a magnetic force between the mouthguard and its particular attachment area. The mouthguard is embedded with the rare-earth magnet in the palatal area. The shape of the magnets most often include, but are not limited to, cylindrical or disk shapes, and the sizes may vary depending on the particular material involved. However, the shape and size of magnets chosen must be inconspicuous to the user, yet of sufficient strength to prevent accidental dislodgement of the mouthguard from its attached position. With my novel design, a magnet as large as 20 mm in diameter can be hidden in the palatal area without being noticeable to the wearer.

[0013] Due to the oral environment, the magnets may be coated with a moisture resistant and wear resistant coating such as nylon, PTFE (Teflon), or other rubber-like material. Alternatively, the magnet may be encased in an impact resistant casing which is sealed with an epoxy-type or plastic-type coating. These magnets may also be embedded in any of the more commonly used mouthguard materials such as EVA (ethylene vinyl-acetate) or other thermoplastics.

[0014] For the purpose of discussion, the area around which the magnetic mouthguard is attached will be referred to as the “docking area”. Similarly, the attachment apparatus to which the magnetic mouthguard is attached is referred to as the “docking station”. When the mouthguard is magnetically attached to the docking station, it will be referred to as being “docked” or in the “docked position”. There are many possible docking areas which include, but are not limited to, the facemask area of a helmet, chin-straps, wristbands, headbands, belts, shorts, pants, and jerseys. Additionally, the docking station may also include, but is not limited to, surfaces appropriate for longer term storage such as the side or ceiling of a locker or the bottom of a skateboard.

[0015] In the ease of facemask attachment, the facemasks themselves are most always constructed of a steel material which makes them intrinsically magnetic. Thus, the magnetic mouthguard may be attached to any area of the facemask in any position desired for convenience. However, my testing has shown that direct attachment to the facemask provides insufficient retentive force and allows for easy dislodgement of the mouthguard with subsequent loss. Another advantage of the present invention is that a more secure attachment is achieved utilizing an attachment apparatus with a novel, non-rigid, magnetic button assembly with elastic properties. This unique docking station assembly may be affixed to the facemask via an impact-resistant plastic clip to form a reliable, secure, docking station. A wide range of impact-resistant plastic materials may be used to fabricate the clip including, but not limited to, polycarbonates, nylons and their mixtures.

[0016] As for wristbands, headbands, and the like, a docking station may be created by inserting a magnet between an inner layer and an outer layer of elastic material. Traditionally, terry cloth, which is made of cotton or a cotton mix, has been used in the manufacture of “sweatbands” by folding the material back on itself, thereby producing an inner and an outer layer. The magnet may be inserted between the two layers of material and affixed either permanently with stitch-
ing, or semi-permanently, utilizing an opening in the outer layer that is closed with a hook-and-loop mechanism or a snap.

[0017] Similarly, for accessories or clothing which utilize a single layer of material such as nylon, polyester, or some of the newer synthetic-mix materials designed specifically for athletic performance, the docking station may be created by attaching the magnet via a pocket or flap which is sewn to the outer surface of the material. In this case, the pocket or flap may be closed utilizing a hook-and-loop mechanism or a snap. Smaller-sized elastic bands may be fabricated for use on belts or chinstraps in a similar fashion.

[0018] Whether a dual-layer fabric design or a single layer fabric design is utilized for creating the docking station, in all instances the material chosen must have excellent elastic properties with an appreciable degree of stretching capability. This unique combination of a magnetic force with an elastic material is very important in the prevention of accidental detachment of the mouthguard from a bump or a jar. Such incidental contact with the mouthguard may go unnoticed by the wearer and lead to permanent loss if the attachment is not secure or reliable.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] FIG. 1 is a perspective view of a mouthguard according to a first embodiment of the disclosure.

[0020] FIG. 2 is a top plan view of the mouthguard according to the first embodiment of the disclosure.

[0021] FIG. 3 is a rear elevational view of the mouthguard according to the first embodiment of the disclosure.

[0022] FIG. 4 is a side elevational view of the mouthguard according to the first embodiment of the disclosure.

[0023] FIG. 5A is a perspective view of prior art.

[0024] FIG. 5B illustrates the prior art of FIG. 5A in a coupled position with the facemask of an athletic uniform.

[0025] FIGS. 6A and 6B are perspective views of prior art.

[0026] FIG. 7 illustrates a docking station according to the first embodiment of the disclosure attached to the facemask of an athletic uniform.

[0027] FIG. 8 illustrates the docking station of FIG. 7 located in an alternate position on the facemask of an athletic uniform.

[0028] FIG. 9 illustrates the mouthguard of FIGS. 1-4 in a docked position with the docking station of FIG. 7.

[0029] FIG. 10 is a perspective view of the docking station according to the first embodiment of the disclosure.

[0030] FIG. 11 is a partially exploded frontal perspective view of the docking station of FIG. 10.

[0031] FIG. 12 is a fully exploded rear perspective view of the docking station of FIG. 10.

[0032] FIG. 13A is a rear perspective view of the elastic magnetic button.

[0033] FIG. 13B is a frontal perspective view of the elastic magnetic button.

[0034] FIG. 14 is a rear perspective view of the docking station of FIG. 10 with rear cover removed to illustrate the elastic attachment of the magnetic button assembly.

[0035] FIGS. 15A, 15B, 15C, and 15D illustrate the elastic nature of the docking station according to a first embodiment of the disclosure.

[0036] FIG. 16 is an exploded view of a prior art rigid clamping system.

[0037] FIG. 17A illustrates an elastic wristband with magnet attached according to a second embodiment of the disclosure.

[0038] FIG. 17B illustrates an elastic wristband with magnet and flap assembly according to a third embodiment of the disclosure.

[0039] FIG. 18 illustrates the mouthguard of FIGS. 1-4 docked to the wristband of FIG. 17A.

[0040] FIG. 19 illustrates the elastic nature of the wristband of FIG. 17A with magnetic attraction to the mouthguard of FIGS. 1-4.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0041] FIG. 1 through FIG. 4 illustrate the mouthguard 21 according to the first embodiment of the present invention disclosed herein. The mouthguard is defined by an outer sidewall, an inner sidewall, a biting surface and a palatal portion. The outer sideway consists of an inner surface 20a, which contacts the labial (outer) surfaces of the teeth, and an outer surface 20b, which contacts the tissue of the cheek posteriorly and the inside surface of the upper lip anteriorly. The inner sidewall consists of an inner surface 22a, which contacts the lingual (inner) surfaces of the teeth, and an outer surface 22b, which contacts the lateral and anterior surfaces of the tongue. The palatal portion extends superiorly from the lingual sideway and consists of an inner palatal surface 24a, which contacts the palatal tissue, and an outer palatal surface 24b, which contacts the dorsal surface of the tongue. Magnet 28, illustrated by the broken lines, is embedded between the inner palatal surface 24a and the outer palatal surface 24b. Tooth impressions 26 are formed within the confines of the inner and outer sidewalls laterally and the occlusal (biter) surface 25 inferiorly. FIG. 2 illustrates the palatal extension of the mouthguard and shows the magnet location anteroposteriorly as well as transversely. FIG. 3 is a rear elevational view which illustrates the vertical location of the magnet embedded between the inner and outer surfaces of the palatal portion. The outer sidewall thickness 30, the inner sidewall thickness 32, the occlusal surface thickness 34, and the palatal portion thickness 33 are represented in FIG. 4.

[0042] FIGS. 5A and 5B illustrate prior art. As seen in FIG. 5A, there is no palatal portion to the mouthguard, only outer peripheral sidewall 40, inner peripheral sidewall 42, and base 43. Magnet 38 is located on the outer periperal sidewall 40. This peripheral placement of the magnet is not ideal since a heavy blow to the mouthguard will result in the magnet being trapped between the offending force and the delicate tooth structure, resulting in possible injury. FIG. 5B demonstrates the same mouthguard of FIG. 5A along with a proposed coupling mechanism to facemask 44. This arrangement positions the mouthguard perpendicular to the binding surface. Such perpendicular orientation makes the mouthguard much more prone to accidental dislodgement due to a fulcrum effect from incidental contact on the mouthguard.

[0043] FIGS. 6A and 6B illustrate another example of relative prior art. Here, the mouthguard contains peripheral sidewalls 100 and 102, but has no palatal portion. In this design, the magnet location is designated for raised scaffolding areas 106a, 106b, and 106c. This location places the magnet or magnets in close proximity to the biting surfaces of the teeth and can cause injury to tooth structure if a blow to the chin forces the upper and lower together. Furthermore, with this design, the offending force is directed and concentrated in the
area containing the magnet rather than dissipating the force along the entire biting surface of the mouthguard 104.

[0044] FIG. 7 is an environmental view of the first embodiment of the present disclosure illustrating a docking station comprised of a magnetic button assembly with novel elastic properties attached to facemask crossbar 46a. FIG. 8 illustrates the docking station located in a different area on facemask crossbar 46b.

[0045] FIG. 9 is an environmental view illustrating the operation of the mouthguard retention system of the first embodiment of the present disclosure. Here, the mouthguard is attached or docked to the novel elastic magnetic button assembly comprising the docking station illustrated in FIG. 7. The novel palatal placement of the mouthguard magnet, which is hidden beneath the inner palatal surface 24a, allows the mouthguard to attach in a parallel arrangement to docking area 46a.

[0046] FIGS. 10, 11, 12, 13A and 13B each illustrate in greater detail the novel elastic magnetic button assembly of the first embodiment of the present disclosure. It is comprised of a hollow tube-like structure 48 which has an opening or slit on the superior side to allow flexure and is designed to accept the crossbar of a facemask in opening 49. Extending upward on each end are buttress supports 52a, 52b, 53a, 53b, 54a, and 54b which attach to front rim 55 and rear rim 56. Front rim 55 contains floor 62 with dumbbell-shaped opening 64. Rear side of floor 62 contains wings 74a and 74b which secure elastic straps 68a and 68b in channels 76a and 76b. The elastic straps are attached anteriorly to magnetic button base 70, which contains grooves 80a and 80b, by retaining washer 69 and screw 66. Stainless screw passes through hole 71 in retainer washer 69, then through hole 73 of magnet 72 and into threaded axial 78 of magnet cover 50. A logo 51 may be added to front surface of magnet cover 50.

[0047] FIG. 14 is a rear view of the docking station of the first embodiment of the present disclosure with rear cover removed, showing elastic straps 68a and 68b passing through dumbbell-shaped opening 64 in base 62. The elastic straps stretch around wings 74a and 74b and rest in channels 76a and 76b. The straps may be comprised of a material with elastic properties including, but not limited to, latex, rubber, nylon, polyester, or a mix of these.

[0048] FIGS. 15A, 15B, 15C, and 15D illustrate the novel elastic properties of the first embodiment of the present disclosure. FIG. 15A shows mouthguard 21 at rest in the attached or docked position. FIG. 15B illustrates the novel stretching action of elastic straps 68a and 68b which occurs with incidental contact, thus keeping the mouthguard securely attached. This novel design prevents the mouthguard from becoming accidentally detached and possibly lost if the user is unaware that such incidental contact has occurred. FIG. 15C illustrates the release of the mouthguard with a sustained force in one direction as the user pulls the mouthguard away from its docked position for insertion into his or her mouth. Final release of the mouthguard occurs only after the elastic straps reach their elastic limit and the stretching action ends. However, as FIG. 15D illustrates, breakage of the elastic straps does not occur, and their elastic property allow them to rebound to their original position retracting the magnetic button to its original position. FIG. 16 is an example of prior art which demonstrates a very rigid, inflexible design with no elastic properties. My experimentation has shown that such rigid systems are not reliable in terms of keeping the mouthguard attached when incidental contact occurs. This is problematic since the user is often unaware that such incidental contact has occurred and the mouthguard can be lost.

[0049] FIG. 17A represents a second embodiment of the present disclosure. This illustrates wristband 110 made of a dual-layered material with magnet 118 inserted into pocket 114 between the inner and outer layers of material. For this embodiment, the material folds back on itself at edge 112 to form the inner and outer layers of material. The pocket may utilize a hook-and-loop mechanism 116 to seal the pocket closed or may be permanently stitched closed. For this embodiment, a logo 120 is permanently sewn to the outer layer of material directly above magnet 118. This will identify to the wearer the docking area to which the mouthguard should be directed for docking.

[0050] FIG. 17B represents a third embodiment of the present disclosure. This illustrates a wristband 122 made of a single-layer material with magnet 118 positioned on pocket base 126, which is permanently sewn to the outer surface of the single layer material. For this particular embodiment, flap 128 is opened for placement of the magnet and then closed with hook-and-loop mechanism 134, which runs along the border of the flap, and hook-and-loop mechanism 132, which runs along the border of pocket base 126. A logo 136 may be located on the outer surface of flap 128 to easily identify to the wearer the docking area to which the mouthguard should be directed for docking.

[0051] FIG. 18 illustrates the operation of the second embodiment of the present disclosure in which mouthguard 21 is attached to wristband 110 which is made of a dual-layered material. Magnet 28 (represented by broken lines) is embedded just below the mouthguard palatal surface 24a and couples with magnet positioned between dual-layered material. The location of said magnet is identified by logo 120.

[0052] FIG. 19 also illustrates a second embodiment of the present disclosure. It demonstrates the magnetic attraction between magnet 28, which is embedded beneath the outer palatal surface 24b of mouthguard 21, and magnet 118, which is located between the inner and outer layer of material of wristband 110. Also illustrated is the elastic nature of the material of said wristband which is represented by contour line 140.

[0053] Although the description above contains many specificities, these should not be construed as limiting the scope of the embodiments but as merely providing illustrations of some of several embodiments. For example, the mouthguard could be made of more than one material in a composite-like manner and could be adapted to many different designs by adding a palatal portion to the mouthguard. Thus, the scope of the embodiments should be determined by the appended claims and their legal equivalents, rather than by the examples given.

The invention claimed is:

1. A protective mouthguard wherein a magnet is embedded in the palatal area of said guard.
2. A docking station wherein the mouthguard of claim 1 is conveniently and temporarily fastened when removed from the mouth.
3. The mouthguard of claim 1, wherein said guard is shaped to cover and protect the upper teeth and also extends palatally to cover or partially cover the palatal surface.
4. The mouthguard of claim 1, wherein the magnet is sized to fit within the palatal portion of said guard.
5. The mouthguard of claim 1, wherein the strength of the magnet is sufficient to support the weight of said guard in a
docked position and sufficient to prevent accidental detachment from said docked position as a result of incidental contact.

8. The mouthguard of claim 1, wherein the magnet is oriented such that said guard is maintained parallel to a docking area when placed in said docked position.

9. The docking station of claim 2, wherein said docking station is located on the crossbar of a facemask.

10. The docking station of claim 9, wherein said docking station components include a magnetic button assembly with elastic properties and an impact resistant plastic clip.

11. The docking station of claim 2, wherein said docking area is located on a wristband, armband, headband or article of clothing.

12. The docking station of claim 11, wherein a magnet is positioned such that the mouthguard of claim 1 is maintained parallel to said docking area when said mouthguard is placed in a docked position.

13. The docking station of claim 11, wherein a magnet is located between an inner and an outer layer of elastic fabric.

14. The docking station of claim 13, wherein a logo is located on the outer surface of said outer layer of elastic fabric to identify the location of said docking area.

15. The docking station of claim 11, wherein a magnet is located in a pouch or pocket that is permanently affixed to the outer surface of a single layer of elastic fabric.

16. The docking station of claim 15, wherein a logo is located on the outer surface of said pocket or pouch to identify the location of said docking area.

* * * * *