DEVICES AND METHODS FOR STRENGTHENING THE THENAR MUSCLES

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Abstract

Described here are devices and methods for strengthening the thenar muscles of the hand. Generally, a device comprises a base shaped to be held in the hand, a thumb rest having a hinge attached to the base such that one end of the thumb rest can be pivoted relative to the base, and an elastic member attached to the base and the thumb rest, which resists the pivoting motion of the thumb rest relative to the base. The user can place the device in his or her hand, and place his or her thumb on the thumb rest. When the user presses the thumb rest toward the base with his or her thumb, the elastic member supplies a force resisting the pressing motion, which exercises the thenar muscles.
place device in palm of hand, with fleshy part of palm near thumb against concave edge

place thumb on thumb rest

press thumb downward toward pinky using thenar muscles

thumb rest is moved toward base, generating resistive force from the elastic member

release thumb rest

elastic member returns to resting state position and thumb rest moves away from base

FIG. 8
DEVICES AND METHODS FOR STRENGTHENING THE THENAR MUSCLES

PRIORITY

[0001] This application claims priority to U.S. Provisional Application No. 61/763,944 filed on Feb. 12, 2013, the entire contents of which are incorporated herein by reference.

FIELD

[0002] This relates to a device for strengthening the thenar muscles in the hand.

BACKGROUND

[0003] Manual dexterity and strength are important for performing activities of daily living but often decline with age. In particular, age is associated with decreased ability to perform gripping actions, which are needed for many daily tasks, such as opening jars and bottles. Gripping actions are dependent on the muscular power of the thenar muscles in the palm of the hand, which include the abductor pollicis brevis, flexor pollicis brevis, and opponens pollicis. These muscles are located at the base of the thumb and abduct, flex, and oppose the thumb. Their strength has been shown to decrease significantly with age, with healthy subjects between 60 and 90 years old having on average half of the motor units in their thenar muscles as compared to subjects between 20 and 40 years old (T.J. Doherty & W.F. Brown, “The estimated numbers and relative sizes of thenar motor units as selected by multiple point stimulation in young and older adults,” Muscle Nerve 16(4): 355-66 (1993)). Gripping ability, and in turn the ability to perform daily activities, can thus be improved by strengthening the thenar muscles of the hand.

[0004] While there are some products that can be used to strengthen the muscles of the hand generally—for example, Theraputty™, a malleable, dough-like putty that can be squeezed—they do not ensure that the user performs the specific motion that will isolate the thenar muscles. Thus, there is a need for a device that guides the user to perform an exercise specifically targeting the thenar muscles for strengthening.

SUMMARY OF THE INVENTION

[0005] Described here are devices and methods for strengthening the thenar muscles of the hand. Generally, the devices comprise a base shaped to be held in the hand, a thumb rest having a hinge attached to the base, such that one end of the thumb rest can be pivoted relative to the base, and an elastic member, such as a spring, attached to the base and the thumb rest, resisting the pivoting motion of the thumb rest toward the base. The user can place the device in his or her hand and place his or her thumb on the thumb rest. When the user presses the thumb rest toward the base with his or her thumb, the elastic member supplies a force resisting the pressing motion. The thumb rest is positioned such that the thumb is pressed toward the pinky finger, which specifically targets the thenar muscles.

[0006] The devices provide several advantages. They may guide the user to perform a specific motion with the thumb that isolates the thenar muscles, specifically targeting them for strengthening. Moreover, the devices may be not only deformable but may also return to their original shape after each complete motion of the thumb, allowing the exercise to be easily repeated. The devices may also be portable and manufactured at a low cost.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. 1 illustrates an exemplary device for strengthening the thenar muscles.

[0008] FIG. 2 illustrates an exemplary thumb rest.

[0009] FIG. 3 illustrates another exemplary thumb rest having a splint-like design.

[0010] FIG. 4A illustrates an exemplary elastic element comprising a compression spring attached to the thumb rest of FIG. 2.

[0011] FIG. 4B illustrates an exemplary elastic element comprising a compression spring within a compressible casing attached to the thumb rest of FIG. 2, with the compressible casing shown in a cross-sectional view.

[0012] FIGS. 5A and 5B illustrate exemplary elastic elements comprising piston-like designs attached to the thumb rest of FIG. 2, with the elastic elements shown in cross-sectional views.

[0013] FIGS. 6A, 6B, and 6C illustrate exemplary perspective, top, and side views of a base, respectively.

[0014] FIG. 7 illustrates an exemplary base with an attached strap.

[0015] FIG. 8 illustrates an exemplary method for using the device to strengthen the thenar muscles.

DETAILED DESCRIPTION

[0016] In the following description of preferred embodiments, reference is made to the accompanying drawings in which illustration of specific embodiments of the invention are shown. It should be understood that other embodiments may be used and structural changes can be made without departing from the scope of the invention.

[0017] This relates to a device for strengthening the thenar muscles of the hand. Generally, the device may comprise a base, a thumb rest attached to the base, and an elastic element that may be attached directly or indirectly at one end to the base and at the other end to the thumb rest. The device may be configured such that when the device is held in the hand and the thumb is placed on the thumb rest, pressing the thumb down to deform the elastic element causes the thenar muscles to contract. Repeating this motion with the thumb can lead to increased thenar muscle strength.

[0018] A particular embodiment of the invention is a device for strengthening the thenar muscles of the hand comprising a base, wherein the base is shaped to fit in the hand, a thumb rest attached to the base, and an elastic member comprising a first end and a second end, wherein the first end is attached to the base and the second end is attached to the thumb rest, and wherein the elastic member is configured to deform when the thumb rest is pressed. The thumb rest may comprise a hinge and/or a retention member configured to keep the thumb in place while the thumb rest is pressed. The elastic member may comprise a compression spring, a piston, and/or an extension spring. The first end of the elastic member may be indirectly attached to the base. The base may comprise a concave side configured to fit against the fleshy part of the palm of the hand near the thumb of the hand, and/or a texturized surface. The base may comprise a strap that fits around the hand. The device may be configured to strengthen the thenar muscles of both the left and right hands.
A particular embodiment of the invention is a handheld device for exercising the thenar muscles of the hand comprising a first rigid object, a second rigid object, a hinge directly or indirectly connecting the first rigid object and the second rigid object, wherein the hinge is configured to cause the first rigid object to pivot relative to the second rigid object, and an elastic member, wherein the elastic member is attached to both the first and the second rigid objects, and wherein the elastic member is configured to resist the pivoting of the first rigid object toward the second rigid object. The first rigid object may be configured to be pivoted toward the second rigid object by pressing the thumb of the hand against the first rigid object and towards the palm of the hand. The device may be configured to activate the thenar muscles when the first rigid object is pressed by the thumb towards the palm. The device may further comprise a base configured to be held in the hand, wherein the hinge directly connects the first rigid object and the second rigid object, and wherein the second rigid object is attached to the base. The elastic member may comprise a compression spring and/or an extension spring.

A particular embodiment of the invention is a method for strengthening the thenar muscles of the hand using a handheld device, wherein the handheld device comprises a base, a thumb rest attached to the base, and an elastic member having a first end and a second end, and wherein the first end is attached to the base and the second end is attached to the thumb rest. The method may comprise pressing the thumb rest toward the base to deform the elastic member using the thumb of the hand, wherein pressing the thumb rest causes the thenar muscles of the hand to contract.

The devices provide several advantages. They may guide the user to perform a specific motion with the thumb that isolates the thenar muscles, specifically targeting them for strengthening. Moreover, they may be not only deformable but may also return to their original shape after each complete motion of the thumb, allowing the exercise to be easily repeated. The devices may also be portable and manufactured at a low cost.

As used herein, “elastic” or “elasticity” describes a property of a material that returns to its original shape after being deformed.

FIG. 1 illustrates an exemplary device for strengthening the thenar muscles of the hand. In the example of FIG. 1, the device 100 may include a base 102, thumb rest 104, and compression spring 106. Base 102 may have a flat shape with three straight sides 124, 126, and 128, one convex side 130, and one concave side 132. Base 102 may be shaped to be comfortably held in the left hand, such that the fleshy part of the palm located near the thumb can fit against the concave side 132 of the base 102, and the fingers of the left hand can be curled around convex side 130, but need not be.

As shown in FIG. 1, the thumb rest 104 may comprise two members 108 and 110 connected by a hinge 112. Lower member 108 of thumb rest 104 may be attached to base 102 along the concave side 132, where the user’s thumb can rest on the thumb rest when the device is held in the left palm. The position of thumb rest 104 may be such that pushing down on it with the thumb while holding the base causes the thumb to make an opposing motion toward the first knuckle of the pinky finger, which isolates the thenar muscles. Lower member 108 may be attached to base 102 by any suitable mechanism, such as but not limited to a hook-and-loop fastener, such as Velcro®, screws, adhesive, or the like. Upper member 110 may remain free to pivot around hinge 112, moving its distal end 116 toward and away from base 102. Attached to distal end 116 of upper member 110 may be the first end 120 of the compression spring 106. The second end 122 of compression spring 106 may be connected to lower member 108 of thumb rest 104, which may be in turn attached to base 102. Thus, the second end 122 of compression spring 106 may be indirectly attached to base 102. Alternatively, the second end 122 of compression spring 106 may be directly attached to base 102. The ends 120, 122 of the compression spring 106 can be either permanently or detachably fixed to the thumb rest 104 and/or the base 102. The configuration of the base 102 and thumb rest 104 may be altered for use with the right hand, as will be described in more detail below.

When base 102 is held in the left hand, the thumb can be placed on the upper member 110 of thumb rest 104. When the thumb is pressed downward toward the pinky finger of the hand, the upper member 110 of thumb rest 104 may be pushed downward toward lower member 108 and toward base 102, pivoting around hinge 112. As a result, compression spring 106 may be compressed, creating a force resisting the motion of the thumb toward the pinky finger. This motion of the thumb may cause the thenar muscles of the hand to contract. When the thumb is released, the stored energy in compressed compression spring 106 may cause upper member 110 of thumb rest 104 to pivot around hinge 112 and move away from lower member 108 and base 102, returning to its original position. Each element of device 100 will be described in greater detail below.

FIG. 2 illustrates the exemplary thumb rest of the embodiment of device 100 in FIG. 1. As described above, the thumb rest 200 may have a bottom member 202 and a top member 204, connected by a hinge 206. The bottom 202 and top 204 members may be made of any material or materials rigid enough not to deform when the device is used, such as but not limited to metal, plastic, or rubber. The bottom 202 and top 204 members may be shaped as tapered rectangles, with rounded ends 212 and 214, respectively. The tapered rectangles may be dimensioned such that a user’s thumb can fit comfortably on top member 204, and the distal end of the thumb is near end 214. In one variation, the width of the bottom member 202 at end 208 and the width of top member 204 at end 210, near hinge 206, may be about 1½ inches. The width of bottom member 202 at end 212 and top member 204 at end 214 may be about ¾ inches. The length of bottom 202 and top 204 members may be about 2 inches. In other variations, the thumb rest may have different dimensions to accommodate thumbs of different sizes. In some variations, the width of bottom member 202 at end 208 and top member 204 at end 210 may be about ½ inches to about 3 inches; the width of bottom member 202 at end 212 and top member 204 at end 214 may be about ½ inches to about 3 inches. The length of bottom 202 and top 204 members may be about 1 inches to about 5 inches. In yet other variations, the top member 204 may have an adjustable length, allowing it to be lengthened or shortened to match the thumb of the user. For example, top member 204 may comprise two slidably connected members, where sliding them apart lengthens top member 204, and sliding them together shortens top member 204. In such a variation, top member 204 may comprise a locking mechanism to maintain a selected length during use. It should be understood that the specific measurements of the thumb rest described herein are for explanatory purposes and do not limit the thumb rest thereto. It should be understood
that the bottom 202 and top 204 members of thumb rest 200 may have different dimensions from each other.

[0027] It should also be appreciated that in other variations the bottom 202 and top 204 members of thumb rest 200 may have other shapes, and need not have the same shape as each other. For example, top member 204 may have any shape suitable for the user’s thumb to apply pressure, such as but not limited to a rectangle, an oval, or triangle. In some variations, the top member 204 may have a concave shape so that the thumb can rest more easily on it. In some variations, top member 204 may be made of more than one separate element. Bottom member 202 may have any shape suitable for connecting the thumb rest 204 to the base. In some variations, the bottom member 202 and/or top member 204 may have holes, hooks, or other elements for attaching the elastic member of device 100 to ends 212 and 214, as will be described in more detail below.

[0028] Hinge 206 may be located at end 208 of bottom member 202 and end 210 of top member 204, such that ends 208 of bottom member 202 and 210 of top member 204 remain fixed, while hinge 206 may allow end 212 and end 214 to move toward and away from each other. Bottom member 202 may have a central tab 216 extending from end 208 that wraps around a pin 218. Top member 204 may have two outer tabs 220 and 222 extending from end 210 that wrap around pin 218 on either side of central tab 216. Central tab 216 and outer tabs 220 and 222 may be pivotable about pin 218, creating hinge 206. It should be appreciated that a hinge may be created through other mechanisms. For example, thumb rest 200 may not have a bottom member 202, and hinge 206 may be directly attached to the base of device 100. As another example, hinge 206 may be integral to the base. It should also be appreciated that other elements can comprise the hinge, such as but not limited to a ball and socket, a spring, a deformable elbow joint, a hook, or the like.

[0029] FIG. 3 illustrates another exemplary thumb rest 300 having a splint-like design with padding and retention members to hold the thumb in place. As in the example of FIGS. 1 and 2, the thumb rest 300 of FIG. 3 may have a bottom member 302 and a top member 304, connected by a hinge 306. The bottom 302 and top 304 members may be shaped as tapered rectangles and comprise rigid layers 316 and 318, respectively. The rigid layers 316 and 318 may comprise any material rigid enough not to deform when the device is used, such as but not limited to a metal, plastic, or rubber. The bottom 302 and top 304 members of thumb rest 300 may have similar dimensions as those described above with respect to thumb rest 200 of FIG. 2. In some variations, the bottom 302 and top 304 members of thumb rest 300 may have similar variations in shape and dimensions as those described above with respect to thumb rest 200 of FIG. 2. Likewise, the bottom 302 and top 304 members of thumb rest 300 may have elements for attaching the elastic member, as described above with respect to thumb rest 200 of FIG. 2 and described in more detail below. Hinge 306 may have a similar design to hinge 206 of FIG. 2, as described in detail above. Generally, hinge 306 may be located at end 308 of rigid layer 316 and end 310 of rigid layer 318, such that end 308 and end 310 remain fixed, while hinge 306 may allow end 312 of rigid layer 316 and end 314 of rigid layer 318 to move toward and away from each other. Hinge 306 may be formed by tabs extending from end 308 and end 310 that can pivot about pin 307, in the same manner as hinge 206 of FIG. 2, as discussed in more detail above. Similarly, the hinge may be created through other mechanisms, as described in more detail above with respect to hinge 206 of FIG. 2.

[0030] In the example of FIG. 3, top member 304 may comprise additional elements to make the thumb rest more comfortable for the user and to keep the user’s thumb in place during use. For example, above rigid layer 318 of top member 304 may be a padding layer 320. The padding layer 320 may be made of any material or materials capable of conforming to or cushioning the thumb to make the thumb rest 300 more comfortable, such as but not limited to polyurethane foam, rubber, or silicone. The padding layer 320 may be concave to allow the thumb to rest easily on thumb rest 300. Although not shown in FIG. 3, in some variations, rigid layer 318 may also be concave. The padding layer 320 may be glued or otherwise attached to rigid layer 318. In addition, extending from the long sides 322 and 324 of top member 304 may be four retention members comprising retention tabs 326 and 328 (located on long side 322) and 330 and 332 (located on long side 324). Retention tabs 326, 328, 330, and 332 may help to hold the thumb in place while the thumb is pressed down on thumb rest 300. Retention tabs 326, 328, 330, and 332 may comprise outer rigid layers 334 and inner padding layers 336. The outer rigid layers 334 may be made of any material sufficiently rigid to hold the thumb in place, such as but not limited to a metal, plastic, or rubber. The outer rigid layers 334 of retention tabs 326, 328, 330, and 332 may be integral to rigid layer 318 of top member 304, or they may be separate pieces attached to rigid layer 318. The inner padding layers 336 may be made of any material capable of conforming to or cushioning the thumb to make the retention tabs more comfortable for the user, such as but not limited to polyurethane foam, rubber, or silicone. The padding layers 336 of retention tabs 326, 328, 330, and 332 may be integral to retention layer 320 of top member 304, or they may be separate pieces. Padding layers 336 may be glued or otherwise attached to the rigid layer 334 of each retention tab.

[0031] It should be appreciated that the thumb rest may have other designs to make the thumb rest more comfortable for the user and/or to keep the user’s thumb in place during use. For example, the thumb rest may have fewer or more retention tabs (e.g., zero, one, two, three, five, six, or more), and/or the retention members may have a different shape. For example, the top member 304 may have one retention member extending along the entire long side 322 and another retention member extending along the entire long side 324 forming hollow half-cylinder-like shape. As another example, a retention member may extend upwards from the end 314 of top member 304 and then curve back parallel to and above top member 304, forming a U-shape that can fit over the user’s thumb, such that the thumb is enclosed on its anterior and posterior sides but exposed on its medial and lateral sides. In some variations, the positions of the retention tabs may be adjustable after manufacturing, for example by using a pair of pliers.

[0032] FIG. 4A illustrates the exemplary elastic element of FIG. 1 comprising a compression spring 400 attached to the exemplary thumb rest of FIGS. 1 and 2. Compression spring 400 may have a first end 402 and a second end 404. The first end 402 may be connected to end 212 of bottom member 202 of thumb rest 200, and the second end 404 may be connected to end 214 of top member 204 of thumb rest 200. In the example of FIG. 4A, end 402 may be wrapped through a hole 406 in end 212 of bottom member 202, and end 404 may be
wrapped through a hole 408 in end 214 of top member 204. The ends 402 and 404 may be detachable from the holes 406 and 408, so that the compression spring 400 can be removed and/or replaced. In other variations, ends 402 and 404 of compression spring 400 may be attached to bottom 202 and top 204 members of thumb rest 200 in any suitable manner, including but not limited to being welded or held in place by a screw or hook.

[0033] When end 214 of top member 204 is pressed toward end 212 of bottom member 202, compression spring 400 may be compressed. As compression spring 400 is compressed, it may exert a force resisting the compression. Thus, when the user’s thumb is used to compress the compression spring 400, the thumb must overcome the resistive force of the compression spring 400, which may activate the thenar muscles. When pressure on the top member 204 from the thumb is released, the compression spring 400 may return to its expanded configuration (as shown in FIG. 4A). The magnitude of the resistive force that the thumb must overcome may be proportional to the stiffness of the compression spring 400. Thus, the compression spring 400 may be chosen based on the desired force to be applied by the thumb. In one variation, the compression spring 400 may have a spring rate of about 20 pounds per inch (i.e., the compression spring 400 may require 20 pounds of pressure to compress by 1 inch). In other variations the compression spring 400 may have a spring rate of about 0.1 pounds/ inch to about 2 pounds/inch, 2 pounds/inch to 5 pounds/inch, about 5 pounds/inch to about 10 pounds/ inch, about 10 pounds/inch to about 15 pounds/inch, about 15 pounds/inch to about 20 pounds/inch, about 20 pounds/inch to about 25 pounds/inch, about 25 pounds/inch to about 30 pounds/inch, about 30 pounds/inch to about 35 pounds/inch, about 35 pounds/inch to about 40 pounds/inch, about 40 pounds/inch to about 45 pounds/inch, about 45 pounds/inch to about 50 pounds/inch, about 50 pounds/inch to about 55 pounds/inch, or about 55 pounds/inch to about 60 pounds/ inch. Compression spring 400 may be made of any suitable material or materials, such as but not limited to steel or steel alloys, nickel or nickel alloys, titanium, and/or Vespel™. In some variations, the compression spring 400 may be interchangeable such that the user may choose which compression spring to attach to the device (e.g., the user may increase the stiffness of the compression spring as the thenar muscles are strengthened over time). In these variations, the compression spring 400 may be attached to the top 204 and bottom 202 members of the thumb rest 200 by a mechanism that can be easily released and re-attached.

[0034] The elastic member may have other designs. For example, FIG. 4B illustrates an alternative exemplary elastic member in which the compression spring 400 of FIG. 4A is within a compressible casing 450. For purposes of explanation, the compressible casing 450 is shown in a cross-sectional view. The compressible casing 450 may have a generally cylindrical shape and may fit around compression spring 400 to ensure that, as compression spring 400 is compressed by pressing on the thumb rest 200, the compression spring 400 does not bend instead of compressing. In the example of FIG. 4B, the compressible casing 450 may comprise an outer cylinder 452 and an inner cylinder 454. Outer cylinder 452 may have a closed bottom end 456 and an open top end 458, and inner cylinder 454 may have a closed top end 460 and open bottom end 462. Outer cylinder 452 may have a larger diameter than inner cylinder 454. Thus, inner cylinder 454 may fit slidably within outer cylinder 452 to form a piecewise hollow cylinder with closed ends. Compression spring 400 may be located within the piecewise hollow cylinder. The compression spring 400 may be attached at its top and bottom ends to end 460 of inner cylinder 454 and end 456 of outer cylinder 452, respectively, but need not be so that the compression spring can be removed and/or replaced.

[0035] Bottom end 456 of outer cylinder 452 may be attached to end 212 of bottom member 202 of thumb rest 200, and top end 460 of inner cylinder 454 may be attached to end 214 of top member 204. As compression spring 400 is compressed, inner cylinder 454 may slide within outer cylinder 452, shortening the overall length of the piecewise hollow cylinder. When pressure on the top member 204 of thumb rest 200 is released, the compression spring 400 may return to its expanded configuration, causing inner cylinder 454 to extend from within outer cylinder 452, lengthening the overall piecewise hollow cylinder to its expanded configuration (as shown in FIG. 4B). In some variations, the compressible casing 450 may have other designs. For example, the inner and outer cylinders may be reversed such that the inner cylinder is attached to bottom member 202 and the outer cylinder is attached to top member 204. As another example, the compressible casing 450 may comprise three or more cylinders, forming a telescoping cylinder formation. Such a design may allow the top member 204 of thumb rest 200 to be pressed closer to bottom member 202, since the minimum length of compressible casing 450 may be shorter. In some variations, the cylinders making up compressible casing 450 may have lips or other mechanisms to prevent the cylinders from disconnecting with each other.

[0036] FIG. 5A illustrates another alternative exemplary elastic member 500 having a piston-like design. For purposes of explanation, the elastic member 500 is shown in a cross-sectional view. In the example of FIG. 5A, the piston-like elastic member 500 may comprise a spring-biased piston 502 within a hollow cylinder 504. Piston 502 may be attached to one end of a piston rod 506, which may extend out of hollow cylinder 504 through opening 508 in the top end 510 of hollow cylinder 504. The other end of piston rod 506 may be attached to end 214 of top member 204 of thumb rest 200. The bottom end 516 of hollow cylinder 504 may be attached to end 212 of bottom member 202. A compression spring 512 may be located within hollow cylinder 504 between piston 502 and the bottom end 516 of hollow cylinder 504. When the user presses with his or her thumb downward on the top member 204 of thumb rest 200, piston rod 506 and piston 502 may be pushed downward within hollow cylinder 504 toward the bottom end 516. As piston 502 is pushed downward, compression spring 512 may be compressed. The compression spring 512 in turn exerts a force resisting the compression, which must be overcome by the thumb, activating the thenar muscles. In some variations, piston-like elastic member 500 may be interchangeable, such that the user may choose a piston-like elastic member 500 having a compression spring with a desired stiffness. In these variations, the piston-like elastic member 500 may be attached to the top 204 and bottom 202 members of the thumb rest 200 by a mechanism that may allow it to be easily released and re-attached. In another variation, the compression spring 512 within the piston-like elastic member 500 may be interchangeable. In another variation, the top end 510 and/or the bottom end 516 of the hollow cylinder 504 may be removable to expose the cylinder interior for easy interchange of the compression spring 512.
FIG. 5B illustrates another alternative exemplary elastic member having a piston-like design 550, having an extension spring 552 instead of a compression spring. For purposes of explanation, the elastic member 550 is shown in a cross-sectional view. In the example of FIG. 5B, an extension spring 552 may be located within hollow cylinder 504 and attached at one end to piston 502 and at the other end to the top end 510 of hollow cylinder 504. The attachment may be by any suitable method, such as but not limited to hooks or loops. When the user presses with his or her thumb downward on top member 204 of thumb rest 200, piston rod 506 and piston 502 may be pushed downward, which in turn stretches extension spring 552. As extension spring 552 is stretched, it may exert a force resisting the extension. Thus, the thumb may need to overcome the resistive force of the extension spring 552, which activates the thenar muscles. When pressure on the top member 204 from the thumb is released, the extension spring 552 returns to its unstretched configuration, causing piston 502 to move upward toward end 510 of hollow cylinder to its original position.

As with a compression spring, the magnitude of the resistive force that the thumb may need to overcome due to extension spring 552 is proportional to the stiffness of the extension spring 552. Thus, the extension spring 552 may be chosen based on the desired force to be applied by the thumb and may have a similar range of spring rates as described with respect to compression spring 400 of FIGS. 4A-4D and 5A. Extension spring 552 may be made of any suitable material or materials, such as but not limited to steel or steel alloys, nickel or nickel alloys, titanium, and/or Eligloy™. In some variations, piston-like elastic member 550 may be interchangeable, such that the user may choose a piston-like elastic member 550 having an extension spring with a desired stiffness. In these variations, the piston-like elastic member 550 may be attached to the top 204 and bottom 202 members of the thumb rest 200 by a mechanism such that it can be easily released and re-attached. In another variation, the extension spring 552 within the piston-like elastic member 550 may be interchangeable. In another variation, the top end 510 and/or the bottom end 516 of the hollow cylinder 504 may be removable to expose the cylinder interior for easy interchange of the extension spring 552.

It should be appreciated that the elastic member may have other designs, including variations and combinations of the elastic members described above. For example, in an alternative exemplary piston-like design, the elastic member may be similar to those in FIGS. 5A and 5B but may have both a compression spring below piston 502 and an extension spring above piston 502. In another alternative embodiment, the elastic member (e.g., any of those described above) may be attached to top member 204 of the thumb rest 200 at a middle location along the length of top member 204, rather than at end 214. In yet another alternative embodiment, the device may comprise two or more elastic members.

FIGS. 6A, 6B, and 6C illustrate exemplary perspective, top, and side views, respectively, of the base of the device described here. In the example of FIGS. 6A-6C, the base 600 may be shaped to be comfortably held in the left hand. Base 600 may have seven sides: two parallel sides 602 and 604 may form the top flat surface and the bottom flat surface, respectively; two parallel straight sides 606 and 608 may form the left and right edges, respectively; convex side 610 may form the top edge; straight side 612 may form the bottom edge; and concave side 614 may form an edge connecting edges 606 and 612. Concave edge 614 may be shaped such that the fleshy part of the left palm located near the thumb fits against it. Convex edge 610 may be shaped to align approximately with the first knuckles of the left fingers, such that the fingers of the left hand can be comfortably curled around convex edge 610, but need not be. In the example of FIGS. 6A-6C, straight edge 606 may be about 1.13 inches long; straight edge 608 may be about 2.56 inches long; convex edge 610 may be about 3.5 inches across, with a radius of curvature of about 4.38 inches; straight edge 612 may be about 1.09 inches long; the corner between straight edges 608 and 612 may have a radius of curvature of about 0.25 inches; and concave edge 614 may have a radius of curvature of about 3.50 inches. The thickness of base 600 (i.e., the distance between the top flat surface 602 and the bottom flat surface 604) may be about 0.50 inches. The corners between the top flat surface 602 and the edges may have a radius of curvature of about 0.13 inches, and the corners between the bottom flat surface 604 and the edges may have a radius of curvature of about 0.06 inches. In other variations, the base may have different dimensions and curvatures to accommodate hands of different sizes. In some variations, edge 606 may be about 0.5 to 3 inches long; edge 608 may be about 1 to 6 inches long; edge 610 may be about 1 to 8 inches across, with a radius of curvature of about 1 to 8 inches; edge 612 may be about 0.2 to 3 inches long; and edge 614 may have a radius of curvature of about 1 to 8 inches. In some variations, the corners between two edges and between an edge and a flat surface may be right angles, or they may have a greater radius of curvature than in the example of FIGS. 6A-6C. It should be understood that the specific measurements of the base described herein are for explanatory purposes and do not limit the base thereto. It should also be understood that the base may have other shapes and different numbers of edges than the ones described here.

The base may be made out of any suitable material or materials, such as but not limited to a molded plastic, rubber, or metal. In some variations, the surfaces and/or edges of the base 600 may be texturized to help the user hold the base more securely. In other variations, all or a portion of the base may be covered with a material or materials, such as but not limited to a fabric, rubber, or silicone, to help the user hold the base more securely (for example by absorbing sweat or providing a tacky surface for gripping), to make the base more comfortable to hold, or to make the appearance of the device more pleasing. In other variations, the base itself or the material covering the base may be decorated with logos, patterns, designs, and/or colors to provide the pleasing appearance.

Although the device described thus far is configured for use in the left hand, in other variations the device may be configured for use in the right hand, or it may be configured for use in either hand. In one variation for use in the right hand, the base may be a minor image of the base 600 shown in FIGS. 6A-6C, such that the concave edge is shaped such that the fleshy part of the right palm located near the thumb fits against the concave edge. In some variations, the same base may be used for both hands by moving the thumb rest (e.g., in a variation having Velcro® attachments, by having two locations on the base with Velcro® to which the thumb rest can be attached). In one of these variations, the thumb rest can be placed in a first position along concave edge 614 and near straight edge 606 for use with the left hand, or in a second position along concave edge 614 and near straight edge 612 for use with the right hand. In this variation, the base 600 may, but need not be, made symmetrical such that the lengths of
straight edges 606 and 612 are equal, and/or edge 608 is convex with the same length and curvature as convex edge 610. In another variation, the same base may be used for both hands by moving the thumb rest from top flat surface 602 to bottom flat surface 604. In this variation, the curvature of the corners between the top flat surface 602 and the edges and between the bottom flat surface 604 and the edges may be made equal, but need not be. In other variations, the same base may be used for both hands by having two thumb rests attached at different positions.

[0043] It should be appreciated that the device may comprise other elements in addition to the ones described here. For example, in some variations, the base 600 may have a strap to help the user hold the base in his or her hand. FIG. 7 illustrates an exemplary strap 700 attached to the base 600 of FIGS. 6A-6C. The user can place his or her hand through the strap 700 to help secure the device in the hand while using the device. In the example of FIG. 7, strap 700 may extend around the bottom flat surface 604 of base 600. End 702 of strap 700 may be attached to straight side 608, and end 704 of strap 700 may be attached to straight side 606. Ends 702 and 704 may be attached to straight sides 608 and 606, respectively, by looping around pins 706 located within indentations 708 in base 600. It should be appreciated that the strap 700 may be attached at different locations on base 600. For example, although in FIG. 7 strap 700 is shown attached to side 608 at the end of edge 608 near edge 610, in other variations, strap 700 may be attached to side 608 closer to side 612, such that when the device is held in the hand, strap 700 is at a more proximal location on the back of the hand. In other variations, strap 700 may be attached at one or both ends to bottom flat surface 604 and/or top flat surface 602. In some variations, the strap may be adjustable or interchangeable to accommodate different hand sizes. For example, the strap may be made of a hook-and-loop fastener, such as Velcro®, that can be looped around pin 706 and adjustable to itself. As another example, the strap may be made out of an elastic material, such as an elastic fabric or rubber, that can stretch around the hand of the user. In yet other variations, the base 600 may have other elements to help secure the device in the hand. For example, a glove may be attached to the bottom flat surface 604 of base 600, and the user may place his or her hand in the glove when using the device. In variations in which the thumb rest is moveable such that the device can be used by the left and right hands, the strap, glove, or any other additional element may also be moveable to accommodate use by both hands.

[0044] As another example, the device may comprise elements to increase its portability. For example, the device may comprise a rubber band or other elastic strap that can be used to hold the thumb rest toward the base when the device is not in use. In variations in which the thumb rest is removable (e.g., in variations in which it is attached to the base with Velcro®), a rubber band or other elastic strap can be used to hold the top and bottom members of the thumb rest together when it is detached from the base. As another example, the device may be placed in a small bag or pouch for ease of transport.

[0045] FIG. 8 illustrates an exemplary method of operating the device of FIGS. 1-7. In operation as illustrated in FIG. 8, the device may be used by holding it in the left or right hand such that the fleshy part of the palm near the thumb is against the concave edge of the base 805. In variations having one or more elements to help the user hold the base in his or her hand, the element(s) may be attached to the hand (e.g., a strap can be placed around the back of the hand, the hand can be placed in a glove). The user may then place his or her thumb on or in the thumb rest 810. The thenar muscles may be exercised by pushing down on the thumb rest so that the thumb moves toward the pinky finger 815. This motion of the thumb may compress the elastic member, causing it to apply a resistive force to the thumb 820. After the thumb rest is pressed, it may be released 825, allowing the elastic member to return to its resting state position, which may push the thumb rest away from the base to its original position 830. This motion of the thumb may be repeated. The device may also be adjusted, such as to change the hand in which it is used, to change the length of the thumb rest, or to change the stiffness of the elastic member.

[0046] Although the foregoing has, for the purposes of clarity and understanding, been described in some detail by way of illustration and example, it will be apparent that certain changes and modifications that will become apparent to those skilled in the art may be practiced, and are intended to fall within the scope of the appended claims. Additionally, it should be appreciated that the devices described here may comprise any combination of device components and features described above.

We claim:

1. A device for strengthening thenar muscles of a hand, comprising:
   a base, wherein the base is shaped to fit in the hand;
   a thumb rest attached to the base; and
   an elastic member comprising a first end and a second end,
   wherein the first end is attached to the base and the second end is attached to the thumb rest, and wherein the elastic member is configured to deform when the thumb rest is pressed.

2. The device of claim 1, wherein the thumb rest comprises a hinge.

3. The device of claim 1, wherein the thumb rest comprises a retention member configured to keep a thumb of the hand in place while the thumb rest is pressed.

4. The device of claim 1, wherein the elastic member comprises a compression spring.

5. The device of claim 1, wherein the elastic member comprises a piston.

6. The device of claim 1, wherein the elastic member comprises an extension spring.

7. The device of claim 1, wherein the first end of the elastic member is indirectly attached to the base.

8. The device of claim 1, wherein the base comprises a concave side configured to fit against the fleshy part of a palm of the hand near a thumb of the hand.

9. The device of claim 1, wherein the base comprises a surface, and wherein the surface is texturized.

10. The device of claim 1, wherein the base comprises a strap that fits around the hand.

11. The device of claim 1, wherein the device is configured to strengthen the thenar muscles of both a left hand and a right hand.

12. A handheld device for exercising thenar muscles of a hand, comprising:
   a first rigid object;
   a second rigid object;
   a hinge directly or indirectly connecting the first rigid object and the second rigid object, wherein the hinge is
configured to cause the first rigid object to pivot relative to the second rigid object; and
an elastic member, wherein the elastic member is attached to both the first and the second rigid objects, and wherein the elastic member is configured to resist the pivoting of the first rigid object toward the second rigid object.
13. The device of claim 12, wherein the first rigid object is configured to be pivoted toward the second rigid object by pressing a thumb of the hand against the first rigid object and towards a palm of the hand.
14. The device of claim 13, wherein the device is configured to activate the thenar muscles when the first rigid object is pressed by the thumb towards the palm.
15. The device of claim 12, further comprising a base configured to be held in the hand, wherein the hinge directly connects the first rigid object and the second rigid object, and wherein the second rigid object is attached to the base.
16. The device of claim 12, wherein the elastic member comprises a compression spring.
17. The device of claim 12, wherein the elastic member comprises an extension spring.
18. The device of claim 12, wherein the elastic member is detachable from the device.
19. The device of claim 12, wherein the elastic member is interchangeable.
20. A method for strengthening thenar muscles of a hand using a handheld device, wherein the handheld device comprises a base, a thumb rest attached to the base, and an elastic member having a first end and a second end, wherein the first end is attached to the base and the second end is attached to the thumb rest, the method comprising:
pressing the thumb rest toward the base to deform the elastic member using a thumb of the hand, wherein pressing the thumb rest causes the thenar muscles of the hand to contract.
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