Rotational Adjustment Device
(RAD)
User Manual
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BACKGROUND

The introduction of cycling cleats in the 1970’s led to an epidemic of knee issues as cyclists changed from riding on flat pedals with toe cages that allowed for a “natural” foot position, to being restrained by cleats nailed to the leather soled shoes that held the foot in a fixed position.

The Rotational Adjustment Device was developed by Bill Farrell, founder and coach of the New England Cycling Academy, and subsequently Fit Kit Systems, to address this issue and determine a suitable cleat position for a cyclist. During the pedal stroke a cyclist’s lower leg (tibia) rotates in and out slightly. A poorly situated cleat restricts this natural gait rotation, resulting in stress being transferred into the knee joint. The objective is to have the cleat position allow for this natural gait pattern, thus preventing equipment induced stress being transmitted to the knee or other joints.

The development and introduction of pedal systems with cleat float went a long way to alleviate the problems of fixed cleats with no float, but did not render the RAD obsolete. This is because most float pedal systems are spring loaded and tensioned to return the cleat to a central position. If the alignment of the cleat is such that the cyclist is working against this resistance, then stress is still transferred to the knee.

Relying on float should never be a substitute for a misaligned or poorly aligned cleat.

There are several adjustments involved in setting a cleat position on a cycling shoe, with the primary three being:

1. Forward / back
2. Medial / lateral
3. Rotation

In addition there may be cause for wedging or shimming.

The primary and singular purpose of the Rotational Adjustment Device is to address the rotational alignment of cleat positioning. This is done through isolating the leg rotation from the cleat alignment during the pedal stroke, and adjusting the cleat alignment to bring the two into agreement.

Use of the Rotational Adjustment Device should be done as the final step, after all other cleat adjustments have been made. No guidance is provided here for the other adjustments.

The Rotational Adjustment Device is a mechanical dynamic bike fitting tool providing a quantitative assessment of where the foot wants to be aligned in relation to the pedal.

No other bike fitting tool including 3D digital systems provide for the assessment and correction of cleat alignment in this manner.

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KIT CONTENTS

The Rotational Adjustment Device (RAD) Kit contains the following:

✓ Storage Case
✓ RAD body, each with 2 determinant bars (2)
✓ RAD calibration bar (1)
✓ Universal Road Adapter (URA) plate with Velcro straps (2)
✓ Universal Mountain Adapter plate (2) - optional
✓ Shimano SPD Adapter plate (2) - optional
✓ Speedplay Zero Adapter plate (2) - optional
✓ Shimano road cleat posts (2 sets of 2 spacers and 2 bolts)
✓ Pedal spacer washers (2)
✓ Universal Mountain Adapter brass post screws (4)
✓ 3/8” box wrench/spanner – for use with the brass post screws
✓ 10/24 x ⅜” flat socket head screw (2) for securing adapter plates to URA
✓ 4mm hex wrench - for securing the URA to the body, and for lateral adjustment
✓ 1/8” hex wrench – for adapter plate connection screw
✓ 9/64” hex wrench – for SPD SL posts and side tension screws and Velcro strap retaining screws.
✓ User Manual

You will also need a pedal wrench for removing / replacing pedals and the RAD. The RAD uses Shimano pedals spindles requiring a standard 15mm flat pedal wrench. Other pedal systems may require a 6 or 8mm hex wrench.

SPARE PARTS
Spare / replacement parts for the RAD are available through the Fit Kit Systems webstore at fitkitsystems.com/shop

REPAIR / REFURBISHMENT
If malfunction, breakage or excessive play develops in your RAD, they can be returned for servicing to Fit Kit Systems. Shipping and service charges are the responsibility of the owner. Contact Fit Kit Systems to discuss any issues before returning them.
OVERVIEW

The RAD is a free floating pedal device that attaches to the bicycle crank in place of the pedals.

The RAD will allow the fitting technician to achieve the correct alignment of the pedal cleat with respect to the riders' naturally rotated gait. This alignment is important to help prevent rotational stresses of the rider's knee, hip or ankle and premature release of the shoe from the pedal. The RAD will also aid in determining the amount of free float that the rider requires based on their biomechanical tracking.
The RAD is set up with the appropriate pedal adapters and installed on the riders' bicycle (or on a fit cycle or sizing cycle). The saddle will need to be raised 1.5cm to account for the difference in height from the pedal axle on the RAD and the pedal system you are working with.

The rider is instructed to pedal naturally without resistance on the wheels until they are familiar with the pedaling motion of the RAD. The rider is instructed to look ahead, not down at their feet. This will keep them from interfering with and influencing their natural leg movement.

The fitting technician then observes the movement of the red and white bars of the RAD.

The white bar is fixed and is an extension of the pedal spindle and therefore a representation of the pedal alignment. The red bar is attached to the float plate and visually indicates the lower leg rotation, and reflects the cleat position. The objective is to see the two bars align, indicating the cleat is centered in the pedal when the leg is centered in its range of rotation.
If you observe that one bar has a tendency to be predominant over the other bar, then a change to the cleat alignment is indicated. Predominant movement of the red bar ahead of the white bar indicates that the rider's heel wants to be out. If the predominant movement of the red bar is behind the white bar, indicates the rider's heel wants to be in.

Adjustment to the cleat is made by locking out the RAD and moving the heel in the direction it wants to be. To do this the cleat screws need to be loosened so that they are still snug but allow movement of the cleat.

This procedure is repeated until there is no predominant movement of the bars during the pedal stroke. You will notice a subtle movement of the bars, slightly ahead to slightly behind. This movement simply indicates biomechanical tracking of the rider's legs and does not need to be adjusted for with the cleat placement but does need to be considered and accommodated with the range of float of the cleat.

The RAD can be used as part of a process of installing new cleats on a cyclist’s shoes, or adjusting the position of existing cleats. If existing cleats are worn, replacement is recommended prior to using the RAD.

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PREPARATION

A one page worksheet (next page) is provided to guide you through the step by step process of setting up and using the RAD. Refer to this worksheet as well as the following information.

This worksheet can also be downloaded for reprinting from fitkitystems.com/education

The left column covers the steps for installation and set-up.

The right column covers the steps for observation and adjustment.

The RAD can be used on the cyclists own bike, or on an adjustable stationary size/fit cycle.

If using the RAD on a cyclists own bike, the bike should be securely mounted in a stationary trainer using an appropriate skewer, and levelled. The resistance unit is to be kept backed off from the wheel so that the rider can spin without any load.

It is not recommended that the RAD be used on a bike on rollers, as the bike needs to be stable and stationary for the feet to enter and exit the device, and for adjustments to be made.

In the Installation procedure existing measurements are taken and recorded, pedals are removed, the RAD’s are installed in place of the pedals, together with the appropriate adapter, and the saddle height is adjusted to account for the stack height of the RAD’s.

CAUTION:

- Ref I 11: The RAD pedal spindle may protrude past the crank arm, potentially leading to chain stay frame damage if the crank arm to chain stay clearance is minimal. Check for clearance prior to the rider mounting the bike. If clearance is an issue, use the included pedal spacer washers and re-adjust the lateral position on the Universal Road Adapter to achieve the correct stance width.

- Ref: I 13: Test the riders shoe/cleat in the RAD by hand before having the rider on the bike. Determine what adjustments are needed other than using the Velcro strap to secure the cleat in the RAD. The side screws may need to be adjusted.
# RAD Cleat Alignment

## Procedure and Worksheet

**Customer Name:**

- Pedal Type: [ ] Road [ ] Mountain / SPD

**Pedal Brand/Model:**

- Cleat Condition: [ ] New Cleat [ ] Existing Cleat

### RAD Alignment Procedure

<table>
<thead>
<tr>
<th>Step</th>
<th>RAD Installation and Configuration</th>
<th>Step</th>
<th>Observe, Measure and Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Verify RAD calibration, ensure determinant bars are aligned and square.</td>
<td>01</td>
<td>Observe drive side determinant bars. Note red bar fore or aft and separation space.</td>
</tr>
<tr>
<td>12</td>
<td>Establish pedal brand, type and cleat condition. Record above.</td>
<td>02</td>
<td>Stop customer from spinning and insert calibration bar into RAD.</td>
</tr>
<tr>
<td>13</td>
<td>Verify cleat position on cycling shoe bottom and loosen cleat securing screws for adjusting.</td>
<td>03</td>
<td>Adjust heal position per observation in Step 01 above. Fore, heal out. Aft, heal in.</td>
</tr>
<tr>
<td>14</td>
<td>Install bike on a level surface and trainer. Set trainer for zero resistance.</td>
<td>04</td>
<td>Have customer resume spinning per Step 115 and observe.</td>
</tr>
<tr>
<td>15</td>
<td>Establish current saddle height and record in CM’s:</td>
<td>05</td>
<td>Repeat Steps 01 through 04 above until determinant bars are properly aligned.</td>
</tr>
<tr>
<td>16</td>
<td>Measure crank surface to pedal center and record in CM’s:</td>
<td>06</td>
<td>Remove right foot from RAD’s and tighten cleat screws per proper torque spec.</td>
</tr>
<tr>
<td>17</td>
<td>Remove existing pedals from bicycle, inspect for damage.</td>
<td>07</td>
<td>Reinsert shoe into RAD and confirm cleat alignment after tightening cleat screws.</td>
</tr>
<tr>
<td>18</td>
<td>Install proper RAD adapter onto RAD’s per pedal information above.</td>
<td>08</td>
<td>Move around to none drive side and have customer resume spinning per Step 115.</td>
</tr>
<tr>
<td>19</td>
<td>Adjust RAD medial/lateral distance per Step 16 above.</td>
<td>09</td>
<td>Observe none drive side determinant bars. Note red bar fore or aft and separation.</td>
</tr>
<tr>
<td>10</td>
<td>Install RAD devices onto crank arms. Confirm RAD centerline to crank surface per Step 16.</td>
<td>10</td>
<td>Stop customer from spinning and insert calibration bar into RAD.</td>
</tr>
<tr>
<td>11</td>
<td>Ensure spindle/chainstay clearance! Cover exposed RAD spindle with electrical tape.</td>
<td>11</td>
<td>Adjust heal position per observation in Step 09 above. Fore, heal out. Aft, heal in.</td>
</tr>
<tr>
<td>12</td>
<td>Raise saddle height 1.5CM +/- to accommodate RAD device height.</td>
<td>12</td>
<td>Have customer resume spinning per Step 115 and observe.</td>
</tr>
<tr>
<td>13</td>
<td>Assist customer in mounting bicycle and secure cleat to RAD devices with Velcro straps.</td>
<td>13</td>
<td>Repeat Steps 09 through 012 above until determinant bars are properly aligned.</td>
</tr>
<tr>
<td>14</td>
<td>Confirm with customer that riding position is correct.</td>
<td>14</td>
<td>Remove left foot from RAD’s and tighten cleat screws per proper torque spec.</td>
</tr>
<tr>
<td>15</td>
<td>Allow customer to spin with no resistance at 70-80 RPM for approximately 5 minutes.</td>
<td>15</td>
<td>Reinsert shoe into RAD and confirm cleat alignment after tightening cleat screws.</td>
</tr>
<tr>
<td>16</td>
<td>Request customer look “down road” or keeps eyes closed during spin.</td>
<td>16</td>
<td>Allow customer to spin normally and confirm comfort.</td>
</tr>
<tr>
<td>17</td>
<td>Begin RAD observation.</td>
<td>17</td>
<td>Remove RAD devices and reinstall customer pedals.</td>
</tr>
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### RAD Procedure Finalization

<table>
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<tr>
<th>Step</th>
<th>Function</th>
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<tr>
<td>F1</td>
<td>Reset customer seatpost to measurement obtained in Step 15 above and confirm.</td>
</tr>
<tr>
<td>F2</td>
<td>Ensure customer pedal entry/exit forces and stability.</td>
</tr>
<tr>
<td>F3</td>
<td>Confirm cleat alignment to center of pedal.</td>
</tr>
<tr>
<td>F4</td>
<td>Discuss results with customer and have customer sign below.</td>
</tr>
</tbody>
</table>

**Customer Signature:**

**RAD Specialist Signature:**

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INSTALL THE APPROPRIATE CLEAT ADAPTERS TO THE RAD BODY

Depending on your RAD KIT, you will have the following cleat adapters:

- Universal Road Adapters
- Universal Mountain Adapters
- Shimano SPD adapters
- Speedplay Zero adapters

Install the appropriate adapters onto the RAD body. The primary adapter is the Universal Road Adapter (URA). The other adapters then attach to this one.

Do this prior to installing the RAD onto the crank arms.

Test fit the riders shoe/cleat in the adapter to test the fit, and note if the cleat is snug or loose.

Some cleats will need to be centered and secured using the side adjustment screws on the Universal Road Adapter.

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THE UNIVERSAL ROAD ADAPTER

Is secured to the RAD body using two hex screws (M5 x 12mm) through the front vertical plate on the adapter.

It can be adjusted laterally so that the distance from the face of the crank arm to the center of the pedal can be replicated.

The Universal Road Adapter (V2016) plate on its own is compatible with the following cleats*:

- Shimano SPD SL
- Look Keo
- Wellgo RC-5 and RC-6 (Look compatible)
- Exustar ARC 10 and 11, BLK 10 and 11 (NOT the R2 versions)
- Time Iclic, Time RXS
- Campagnolo

The URA is NOT compatible with the Garmin Vector cleats which are Exustar ARCR2 cleats.

*Note that earlier versions of the URA are not compatible with all cleats on the list above, including Look Keo.
Other Adapters

Additional adapter plates are mounted with a single screw to the top of the Universal Road Adapter. These are for:

- Speedplay Zero cleats (not other models of Speedplay with non-adjustable float)
  - For Speedplay Zero and Pave pedals
- Shimano SPD (mtb) cleats
  - For SPD compatible pedals
- Universal Mountain cleats (non SPD)
  - For two hole cleats on the standard 14mm spacing that are not compatible with the SPD adapter plate E.g. Crank Brothers.

Further secure the adapter plates by screwing in the tension screws on each side of the Universal Road Adapter.

SPEEDPLAY ZERO

Secure the cleat mounting screws fully, as being a 4 hole pattern mount, there is no rotational adjustment available in the cleat position. Instead this comes from the spring tab and float adjustment.

Begin by centering the spring tab on the cleats before the cyclist mounts the bike, and zeroing out the float i.e. the float adjustment screws are fully in against the centered spring tab.

There are two phases to the rotational adjustment of Speedplay Zero cleats:

a/ spring tab adjustment

Observe the determinant bars and to see if there needs to be more heel out or heel in. Have the rider stop pedaling and adjust the float limiting screws, until the desired determinant bar alignment is achieved. Maintain a zero amount of float by adjusting both screws. i.e back out one screw and move the other one in. The objective is to move the spring tab, not to provided float.

b/ float range adjustment

Back off the float adjustment screws equally from the spring tab. The more “noise” in the determinant bars (range of movement), the more float the rider requires.
**UNIVERSAL MOUNTAIN**

The Universal Mountain Adapter is used for non SPD cleats that use a standard 2 hole, 14mm wide spacing.

This Adapter is used together with the set of 4 brass post screws.

Replace the cleat screws with the brass posts, or install new cleats with the brass post screws.

Lightly grease the threaded screw, screw it in by hand to secure the cleats lightly. Use the supplied 3/8” box wrench if additional torque is needed.

With the cyclist on the bike, the protruding posts should be aligned to insert into the holes in the Universal Mountain Adapter Plate, with the shoes secured using the Velcro straps.

Perform the RAD observation and adjustment.

When the correct alignment has been obtained, use the supplied 3/8” box wrench to snug up the cleat post screws while the rider is still secured to the RAD. There is clearance between the cleat and the adapter plate to do this. Make sure you are tightening the screws, not loosening them. It is easier to access the posts from the front of the RAD with the wrench.

Have the rider pedal to re-check the alignment.

Have the rider dismount and remove their shoes.

Replace the brass post screws one at a time with the actual cleat screw, lubed and tightened to spec. Be careful not to alter the rotational alignment of the cleats during this process. TIP: use a cleat marking pen to notate the position of the cleat before changing out the screws.
With SPD mountain bike cleats, the serrated teeth pattern on the underside of the cleat tends to bed into the sole of the cycling shoe, making subtle rotational alignment corrections difficult. This will not be a problem if you are aligning new cleats on new shoes, but could be if you are dealing with existing shoes with cleat imprints. You may need to not only loosen the cleat screws enough to pry the cleat teeth out of the sole, but may have to remove the cleats and lightly file the sole of the shoe to reduce friction, and resistance to being rotated.

Be aware that when tightening cleat screws after the rotational alignment, the cleat may get pulled back into a previous position, unless the forward/back or medial /lateral alignments have also been changed, disrupting the teeth pattern.
ADDITIONAL NOTES

CONNECTING THE CYCLIST’S CLEATS TO THE RAD

Have the rider mount the bike, and guide each cleat into the RAD by hand. Instruct the rider to keep their foot relaxed, as no pressure is required to engage into the adapters.

Secure the shoe to the RAD with the Velcro strap.

The side tension screws on the URA may also need to be adjusted to tension a cleat and reduce side play.

DURING THE ADJUSTMENT PROCESS

During the road cleat adjustment, it is important to make certain that the cleat stays seated in the adapter plate. The plastic cleats will have a tendency to "walk" out of the adapter as side pressure is applied to make adjustments to the cleat, resulting in a misreading of the determinant bars, and in turn, a misaligned cleat.

OBSERVING and ADJUSTING

Advise the rider that there will be no resistance on the trainer, and that they will feel like they are pedaling on ice. This allows for the natural lower leg rotation to be displayed, without muscular compensation from pedaling under load.

Have the cyclist pedal for a few minutes to get used to the feeling of riding with no resistance.

Observe the red and white determinant bars of the RAD’s while the rider is pedaling. The red determinant bar will indicate the direction the cleat needs to be rotated. This adjustment is accomplished by moving the heel in the indicated direction. Twisting the heel will cause the cleat to rotate on the sole of the shoe (remember the cleat screws are loosened)

- If the red bar is ahead of the white bar, move the heel out.
- If the red bar is behind the white bar, move the heel in.

To perform the adjustment, move the cyclist’s heel to square up the rad body to align the two bars and insert the calibration bar into the gap in the RAD body in front of the bars. This locks out the float. Now place one hand around the heel of the shoe, and one around the toe. Apply a gentle amount of force to the shoe heel to move it in the desired direction, causing the cleat
to be rotated in relation to the shoe. Usually only a subtle movement is needed.

Remove the bar and re-observe as the cyclist pedals.

Rarely will you have the two bars aligning after the first adjustment. You may have to apply more twist, or you may have over corrected.

You are looking for and adjusting for the predominant movement of the red bar (i.e.) the direction the bar moves and stays, not the pulsing movement. The pulsing movement of the red bar either side of the white bar is indicating the amount of free float needed.

When the determinant bars of the RADs are consistently lining up, you will notice a tendency of the red bar to slightly "go ahead" of the white bar on the down stroke and then slightly behind on the up stroke. This indicates nothing more than the subtle movement of the foot. There should be no predominant movement of the red bar in either direction during the pedal stroke.

**SECURING THE CLEATS**

Once the rotational alignment is achieved, the cleats screws need to be tightened while the rider is still on the bike.

Undo the Velcro strap and lift the cyclist’s foot out of the adapter. Be careful not to inadvertently rotate the cleat when removing the feet/cleat from the RAD to tighten the cleat screws. Remind the rider to keep passive and not reflexively twist their foot to come out of the “pedal”. You want a direct lift off the RAD, not a twist.

Tighten the cleat screws while the rider is still on the bike, reinsert the cleat into the RAD and recheck the alignment.

The easiest way to remove and support the foot to tighten the cleats is to be alongside the rider but facing the rear of the bike. Lift the foot and flex the leg back, supporting the rider’s lower leg in your arm or on your knee. It’s like shoeing a horse, if you have seen that!

**NOTE:** cleat screw tightening follows a different procedure if using the Universal Mountain Adapters. See notes relating to that adapter.
AFTER USING THE RAD

Following the completion of the cleat rotational adjustment, removal of the RAD and installation of the rider’s pedals.....

Reset the saddle height and make any fine-tuning adjustments to the saddle fore/aft and tilt positions and check to make certain the cleats enter and exit smoothly from the pedals.

Listen to the client/cyclist comments as to how he/she feels on the pedals. These comments are important and valid and should always be taken seriously and used as an opportunity to double-check your work.

The objective is to prevent or minimize knee pain, not to aggravate it. However as a cyclist is accustomed to a certain position, a change may require re-adaptation, and there may be some temporary discomfort associated with that.

CARE and FEEDING

The Rotational Adjustment Devices are precision machined and hand assembled and calibrated to provide many years of reliable service.

No lubing, disassembly or cleaning is needed, other than a wipe down if they get dirty.

Always keep the RAD bodies (and other parts) in the storage case when not in use.

The key to reliability and accuracy is to make sure the determinant bars do not get bent, and remain squarely aligned to the body and each other. If one gets slightly bent, use a set square as a guide and “cold set” the bar.

Keep a close eye on the small parts, so as not to lose any.

Replacement parts and servicing are available.