Mobil-Aider™
Joint Mobility Measurement Device

Deluxe Kit User Guide

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Version 1.9
US Patent # 11,123,007
FDA Cleared as Class 1 Exempt

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The Mobil-Aider™ – innovative orthopedic technology

Indications for Use

The Mobil-Aider™ is an orthopedic device used during joint mobilization to **measure linear translation** of a joint. It enables the clinician to quantify (in millimeters) the linear translation, i.e. arthrokinematic glides. The multiple attachments in the kit accommodate various contours of multiple joints.

Introduction

Millions of musculoskeletal injuries occur each year, resulting in pain, swelling, and aberrations in joint movement. The consequences of pain and swelling are the cyclic development of scar tissue and connective tissue shortening making it difficult to move which in turn results in more pain and swelling. If a joint is surgically repaired or casted/splinted, immobilization has been shown to create soft tissue changes that impair joint mobility. Joint mobilization techniques have been reported to realign connective tissue fibers, abate pain, and restore the normal gliding of the bones within the joint to improve motion (7). Treatments rendered must be precise to be efficacious for the return of prior function. Inadequate treatment can delay restoration of motion, inhibit the return of prior function, and have financial repercussions in terms of lost wages and increased healthcare costs.

The precise treatment may involve specific joint mobilizations. A joint mobilization technique involves the passive gliding/linear translation of one joint surface relative to another (**Figure 1**). There are four grades of joint mobilization which are defined based on the amplitude of oscillations and the percentage of the maximum possible linear translation of a joint (16). However, the clinical application of these techniques has been reported to be quite variable (3), and this lack of consistency can have a significant effect on patient recovery (2, 11, 14). The criteria for each of the four grades of joint mobilization (I – IV) are displayed in **Figure 2**.

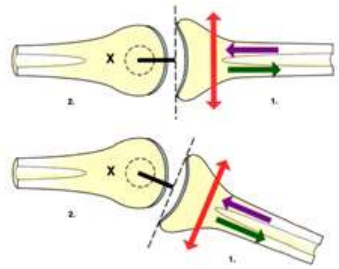
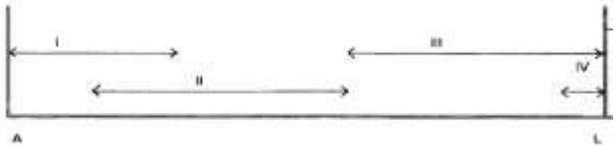


Figure 1. Arthrokinematics, i.e. linear motion of one joint surface on another

- Grade I – small (1-2 mm) amplitude motions in the first quarter (beginning) of the available joint translation
- Grade II – larger (2-4 mm) amplitude motions in the first half of the available joint translation
- Grade III – larger (2-4 mm) amplitude motions in the second half of available joint translation, into the end-range
- Grade IV – small (1-2 mm) amplitude motions at the last quarter of the available joint translation, into the end-range.



Millimeters of Available Motion
A = starting position of movement L = point of limitation of movement

Figure 2. Grades of joint mobilization

Grade I and II mobilizations are used for pain relief via inhibition of nociceptive stimuli. Grade III and IV mobilizations are used for tissue deformation and mechanical distention to reduce stiffness and stretch shortened tissues.

Table 1 and 2 provide the Absolute Contraindications and Relative Precautions, respectively, for joint mobilizations.

 **Table 1. Absolute Contraindications** 	
• Cancer in treatment area	• Joint swelling
• Spinal cord injury	• Joint arthritis
• Acute inflammation	• Nerve injury
• Fracture in treatment area	• Surgery in the treatment area
• Stroke or heart problems	• Blood clotting disorder
• Joint laxity	• Circulation problems

 **Table 2. Relative Precautions** 	
• Suspected cancer in treatment area	• Skin rash or wound in treatment area
• Joint replacements	• Connective tissue disorder
• Pregnancy	• Bone disease
• Blood clotting therapy	• Long-term use of corticosteroids

One can appreciate the cognitive elements of treatment, but unless this knowledge can be transitioned to the psychomotor skill in a clinical setting, it is of little use. Mastering a psychomotor skill requires purposeful practice with feedback. Performance of clinically consistent joint mobilization is a critical component of efficacious treatment (6,7,9). A systematic review (3) spoke to the poor inter-rater reliability and the need to be able to perform a joint mobilization in the correct range of excursion to achieve a desired goal. One should be able to objectively distinguish the various grades of mobilization because of the physiologic impact:

- Grade I and II mobilizations are used for pain relief via inhibition of nociceptive stimuli
- Grade III and IV mobilizations are used for tissue deformation and mechanical distention to reduce stiffness and stretch shortened tissues.

At this time, the only method of obtaining feedback is subjective. The clinician relies on the "feeling" of the joint motion, the "sense" of tissue tension, and the "quality" of the resistance to motion. The solution to this problem,The Mobil-Aider™, will help the novice practitioner stay in the proper plane of motion parallel to the joint surface (avoiding angular or sheer motions), grade the amount of motion correctly, and perform consistent motions during and between treatment sessions. It will help the seasoned clinician be more consistent and to quantify joint mobility.

The concurrent validity and reliability of the Mobil-Aider™ has been successfully tested in the laboratory. Bench testing revealed very high reliability (Cronbach alpha = 0.992 - 0.997) as well as concurrent validity (ICC & Pearson correlations = 0.986 - 0.998).

General Mobil-Aider™ Instructions

The Mobil-Aider™ is designed to be used on different joints for a variety of mobilization techniques. Through the interlocking dove-tail design, the attachments can be changed for the shoulder, elbow, wrist, knee, and ankle. The Deluxe Mobil-Aider Kit includes one (1) of each of the following components. Each of the colorful attachments is identified with a letter **(Figure 3).**

Figure 3. Identification of Mobil-Aider™ Attachments

H-B (Strap) Red			**Base Unit: H-A Screen H-1 Non-Screen side**
H-C Yellow			**H-2 (Strap) Knee Proximal Black**
H-D Blue			**H-3 Thumb-hold Black**
H-E Green			
H-F Beige			

Table 3 identifies the recommended attachment for the corresponding joint mobilization technique.

Table 3. Attachment Number & Use		
Attachment Identification	**Attachment Use**	**Technique**
H-2 Black	Knee component	Knee
H-3 Black	Standard component	All but knee
H-E Green	Sternoclavicular posterior glide	Shoulder horizontal abduction
H-D Blue	Shoulder posterior glide (supine)	Shoulder rotation
H-E Green	Shoulder anterior glide (prone)	Shoulder rotation
H-E Green	Shoulder inferior glide	Shoulder elevation
H-E Green	Elbow medial/lateral glide	Elbow flexion/extension
H-F White	Wrist volar/dorsal glide	Wrist extension/flexion
H-E Green	Wrist medial/lateral glide	Wrist radial/ulnar deviation
H-B Red	Knee anterior glide (supine)	Knee extension
H-C Yellow	Knee anterior glide (prone)	Knee extension
H-C Yellow	Talocrural anterior glide (prone)	Ankle plantarflexion
H-E Green	Talocrural posterior glide (supine)	Ankle dorsiflexion
H-E Green	Subtalar medial/lateral glide	Ankle eversion/inversion

However, since every individual has a unique shape, the clinician may find another attachment to be a better "contour" for some individuals. Regardless of the attachment selected, (parts) H-B, H-C, H-D, H-E, and H-F will only match the dovetail on the "screen side" (**Figure 4**) and (parts) H-2 and H-3 will only match the dovetail on the "non-screen side"(**Figure 5**).

Figure 4. Screen side

Figure 5. Non-screen side

Key points:

1. Individuals using the Mobil-Aider™ should be properly trained in manual techniques prior to use
2. It is recommended to assess the uninvolved joint first to obtain a baseline value and allow the patient to be comfortable with the technique(s).

Technique:

1. Select the appropriate components for the technique.
2. Slide each component into the appropriate slot until the spring plunger snaps into place. Failure to engage a component completely into the slot can pinch the patient's skin with use.
3. Position the patient and explain the technique.
4. Power the Mobil-Aider™ device on by moving the switch to the **ON** position.
5. The fuel gauge (image of a battery) will indicate the status of the battery (in %)

6. Select the **"A" or "B" mode** by moving the mode switch to "A" or "B"
    a. **A Mode** = holds the maximal reading on the screen for 3 seconds prior to resetting to zero; recommended for joint testing and initial joint measurements of mobility.
    b. **B Mode** = real-time readings allow the clinician to see a reading on the display for the position of the joint at any point in time; recommended for joint mobilizations.
7. Align the axis (space between the screen-side and the non-screen side) of the Mobil-Aider™ with the joint line.
8. Stabilize the proximal component of the Mobil-Aider™ against the patient with one hand of the clinician.
9. Secure the distal component of the Mobil-Aider™ against the patient with the clinician's other hand
10. Good contact between the device/patient will enhance the comfort of the technique and reduce likelihood of error.
11. Assure the patient is relaxed.
12. Translate the distal segment on the stabilized proximal segment in the appropriate direction (see **Table 3**).
13. View the screen for the value of the translation (displayed in millimeters of motion).
14. The clinician may also be able to appreciate the qualitative aspect of the technique, i.e. the endfeel.
15. If the technique is to be repeated, simply relax the grip on the device to allow the device to return to the starting position (screen should read "0"). If in the A mode this will occur is 3 seconds. If in the B mode it will occur instantaneously.

Key to graphics:

X = point of stabilization ➡ direction of applied force

Specific Instructions for Joint Mobilization:

Sternoclavicular Posterior Glide (Figure 6)

Figure 6. S-C Posterior Glide

Purpose: To improve horizontal abduction
Components: Green (H-E) attached to screen side to stabilize and Black (H-3) attached to non-screen/moving side
Position: Patient in supine with clinician at the head facing the feet.
Stabilization: Clinician aligns the axis of the Mobil-Aider™ with the sternoclavicular joint line. The device is stabilized on the sternum with the clinician's medial hand.
Mobilization: The moveable component of the device is placed in contact with the medial clavicle. The clinician's lateral hand is placed on the moveable component of the device to perform a posterior glide.

Glenohumeral Inferior Glide (Figure 7)

Figure 7. G-H Inferior Glide

Purpose: To improve elevation of the humerus
Components: Green (H-E) attached on screen side to stabilize and Black (H-3) attached on non-screen/moving side
Position: Patient in supine with clinician at the head facing the feet.
Stabilization: Clinician aligns the axis of the Mobil-Aider™ with the glenohumeral joint line. The device is stabilized proximally with the clinician's medial hand.
Mobilization: The moveable component of the device is placed in contact with the superior humeral head. The clinician's lateral hand is placed on the moveable component of the device to perform an inferior glide.

Glenohumeral Posterior Glide (Figure 8)

Purpose: To improve rotation of the humerus

Components: Blue (H-D) attached on screen side to stabilize and Black (H-3) attached on non-screen/moving side

Position: Patient in supine with clinician alongside the patient.

Stabilization: Clinician aligns the axis of the Mobil-Aider™ with the glenohumeral joint line. The device is stabilized proximally on the anterior chest with the medial hand.

Mobilization: The moveable component of the device is placed in contact with the anterior humeral head. The clinician's lateral hand is placed on the moveable component of the device and glided posterior/lateral.

Figure 8. G-H Posterior Glide

Glenohumeral Anterior Glide (Figure 9)

Purpose: To improve rotation of the humerus

Components: Green (H-E) attached on screen side to stabilize and Black (H-3) attached on non-screen/moving side

Position: Patient in prone with clinician alongside the patient.

Stabilization: Clinician aligns the axis of the Mobil-Aider™ with the glenohumeral joint line. The device is stabilized proximally on the posterior shoulder/scapula with the medial hand.

Mobilization: The moveable component of the device is placed in contact with the posterior humeral head. The clinician's lateral hand is placed on the moveable component of the device and glided anterior/medial.

Figure 9. G-H Anterior Glide

Humeroulnar Medial Glide (Figure 10)

Purpose: To improve flexion of the elbow

Components: Green (H-E) attached on screen side to stabilize & Black (H-3) attached on non-screen/moving side

Position: Patient in supine with clinician alongside the patient. The elbow should be in 90° of flexion.

Stabilization: Clinician aligns the axis of the Mobil-Aider™ with the humeroulnar joint line. The device is stabilized proximally on the lateral humerus.

Mobilization: The moveable component of the device is placed in contact with the olecranon/ulna to impart a medial (downward) force.

Figure 10. H-U Medial Glide

Humeroulnar Lateral Glide (Figure 11)

Purpose: To improve extension of the elbow

Components: Black (H-3) attached on non-screen side to stabilize & Green (H-E) attached on screen/moving side (reversed to pull up)

Position: Patient in supine with clinician alongside the patient. The elbow should be in 90° of flexion.

Stabilization: Clinician aligns the axis of the Mobil-Aider™ with the humeroulnar joint line. The device is stabilized proximally on the lateral humerus.

Mobilization: The moveable component of the device is placed in contact with the olecranon/ulna to impart a lateral (upward) force.

Figure 11. H-U Lateral Glide

Radiocarpal Dorsal Glide (Figure 12)
Purpose: To improve wrist flexion
Components: White (H-F) attached on screen side to stabilize & Black (H-3) attached on non-screen/moving side
Position: Patient seated with the elbow in 90° of flexion and forearm stabilized in supination.
Stabilization: Clinician aligns the axis of the Mobil-Aider™ with the radiocarpal joint line. The device is stabilized proximally on the anterior radius.
Mobilization: The moveable component of the device is placed in contact with the proximal row of carpals. A dorsal force is applied through the proximal carpals.

Figure 12. Radiocarpal Dorsal Glide

Radiocarpal Volar Glide (Figure 13)
Purpose: To improve wrist extension
Components: White (H-F) attached on screen side to stabilize & Black (H-3) attached on non-screen/moving side
Position: Patient seated with the elbow in 90° of flexion and forearm stabilized in pronation.
Stabilization: Clinician aligns the axis of the Mobil-Aider with the radiocarpal joint line. The device is stabilized proximally on the posterior radius.
Mobilization: The moveable component of the device is placed in contact with the proximal row of carpals. A volar force is applied through the proximal carpals.

Figure 13. Radiocarpal Volar Glide

Radiocarpal Medial Glide (Figure 14)
Purpose: To improve radial deviation
Components: Green (H-E) attached on screen side to stabilize & Black (H-3) attached on non-screen/moving side
Position: Patient seated with the elbow in 90° of flexion and forearm stabilized.
Stabilization: Clinician aligns the axis of the Mobil-Aider with the radiocarpal joint line. The device is stabilized proximally on the radius.
Mobilization: The moveable component of the device is placed in contact with the proximal row of carpals. A medial force is applied through the proximal carpals.

Figure 14. Radiocarpal Medial Glide

Radiocarpal Lateral Glide (Figure 15)
Purpose: To improve ulnar deviation
Components: Green (H-E) attached on screen side to stabilize & Black (H-3) attached on non-screen/moving side
Position: Patient seated with the elbow in 90° of flexion and forearm stabilized.
Stabilization: Clinician aligns the axis of the Mobil-Aider with the radiocarpal joint line. The device is stabilized proximally on the radius.
Mobilization: The moveable component of the device is placed in contact with the proximal row of carpals. A lateral force is applied through the proximal carpals.

Figure 15. Radiocarpal Lateral Glide

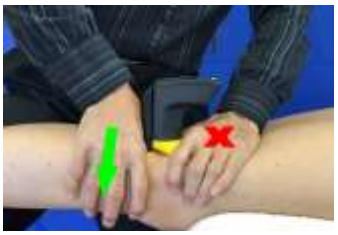
Tibiofemoral Anterior Glide (Lachman Test – Figure 16)

Figure 16. Classic Lachman

Purpose: To measure tibial anterior translation as a test or improve knee extension
Components: Red (H-B) attached on screen/moving side and Black (H-2) attached on non-screen side.
Position: Patient is positioned in supine. The contour of the device will put the patient in ~20° of knee flexion. Ensure the hamstring muscles are relaxed by palpating the tension in the tendons.
Stabilization: Clinician palpates the tibiofemoral joint line and aligns the axis of the Mobil-Aider with the joint line. The device is stabilized proximally on the anterior femur with the corresponding strap and tightened as much as comfortably possible.
Mobilization: The moveable component of the device is placed in contact with the anterior tibia. It is secured with the corresponding strap and tightened as much as comfortably possible. An anterior force is applied to the tibia.

Tibiofemoral Anterior Glide (Figure 17)

Figure 17. Tibiofemoral Anterior Glide



Purpose: To improve knee extension
Components: Yellow (H-C) attached on screen side to stabilize and Black (H-2) attached on non-screen/moving side
Position: Patient is positioned in prone; the contour of the device will place the knee in ~20° of flexion.
Stabilization: Clinician aligns the axis of the Mobil-Aider™ with the tibiofemoral joint line. The device is stabilized proximally on the posterior femur.
Mobilization: The moveable component of the device is placed in contact with the posterior tibia to apply an anterior force.

Talocrural Anterior Glide (Figure 18)

Figure 18. Talocrural Anterior Glide

Purpose: To improve plantarflexion
Components: Yellow (H-C) attached on screen side to stabilize and Black (H-3) attached on non-screen/moving side
Position: Patient is positioned in prone with foot over the edge of the table and a towel under the anterior distal tibia.
Stabilization: Clinician aligns the axis of the Mobil-Aider™ with the talocrural joint line. The device is stabilized proximally on the posterior tibia.
Mobilization: The moveable component of the device is placed in contact with the calcaneus to apply an anterior force to the talus through the calcaneus.

Talocrural Posterior Glide (Figure 19)

Figure 19. Talocrural Posterior Glide

Purpose: To improve dorsiflexion
Components: Green (H-E) attached on screen side to stabilize and Black (H-3) attached on non-screen/moving side
Position: Patient is positioned in supine with foot over the edge of the table
Stabilization: Clinician aligns the axis of the Mobil-Aider with the talocrural joint line. The device is stabilized proximally on the anterior tibia.
Mobilization: The moveable component of the device is placed in contact with the anterior talus to apply a posterior force to the talus on the tibia. Wrapping the hand around the foot to capture the calcaneal can help to facilitate passive dorsiflexion.

Subtalar Medial Glide (Figure 20)

Purpose: To improve eversion
Components: Green (H-E) attached on screen side to stabilize and Black (H-3) attached on non-screen/moving side
Position: Patient is positioned in sidelying with foot over the edge of the table
Stabilization: Clinician aligns the axis of the Mobil-Aider with the subtalar joint line. The device is stabilized proximally on the lateral talus.
Mobilization: The moveable component of the device is placed in contact with the lateral calcaneus to apply a medial force to the calcaneus on the talus. Wrapping the hand around the foot to capture the calcaneal can help to facilitate the motion.

Figure 20. Subtalar Medial Glide

Subtalar Lateral Glide (Figure 21)

Purpose: To improve inversion
Components: Green (H-E) attached on screen side to stabilize and Black (H-3) attached on non-screen/moving side
Position: Patient is positioned in sidelying with foot over the edge of the table
Stabilization: Clinician aligns the axis of the Mobil-Aider with the subtalar joint line. The device is stabilized proximally on the medial talus.
Mobilization: The moveable component of the device is placed in contact with the medial calcaneus to apply a lateral force to the calcaneus on the talus. Wrapping the hand around the foot to capture the calcaneal can help to facilitate the motion.

Figure 21. Subtalar Lateral Glide

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Docketing Station and Charging Port (Figure 22)

The Mobil-Aider™ device and the attachments are housed in a docking station with an adjacent charging port. The Mobil-Aider™ device is rechargeable. When first obtaining the device, please charge completely via the charging port

- To charge the Mobil-Aider™, all attachments must be removed.
- Slide the device screen-side first onto the charging/docking station
- Plug the android end of the recharging cord into the back of the charging port
- Attach the USB end into the AC adapter
- Plug the AC adapter into the wall outlet
- The fuel gauge will indicate the status of the battery
- Duration of the charge will be influenced by usage

Figure 22. Docking Station with Charging Port

Interpretation of Data

The Mobil-Aider™ will provide data in millimeters. The clinician can use these measurements of linear translation to compare to the uninvolved joint. The data can also help to provide feedback for consistent application of joint mobilization techniques. The Mobil-Aider™ is **not** a diagnostic device. It is a reliable and accurate measurement tool of linear displacement, i.e. arthrokinematic motion.

Possible Error Sources

1. Failure to align the axis of the device with the joint axis will influence the quantity of motion
2. Failure to achieve muscle relaxation could decrease translation
3. Failure to keep the device tight against the patient's skin may result in an erroneous reading (interface error)

General Maintenance

Cleaning: The Mobil-Aider may be cleaned with anti-microbial wipes. After wiping off the device, allow the surface to air-dry. Liquids of any kind should never be applied to the device. It should never be submerged in any liquid at any time.

Calibration Check

- The device is calibrated prior to shipping.
- An optional calibration block is available for purchase (**figure 22).** This calibration block will allow the owner to periodically assess the consistency of the Mobil-Aider™. To use the calibration block:
  - First remove all attachments from the base device
  - Slide screen-side of the device onto the dovetail of the challenge block in the direction of the arrow.
  - Place the calibration pin in the 2, 5, 10, or 14 slot.

- With the power "on" and the device in the "A" mode, translate the non-screen side of the device down to the challenge block pin & hold for 2 seconds for a reading to be displayed.
- The screen value should be within 5% of the selected pin, i.e. 2 mm pin = 2.0 ± 0.2 or from 1.8 – 2.2 mm
- Testing can be repeated in the "B" mode. Translate the non-screen side of the device down to the challenge block pin & hold for 2 seconds for a reading to be displayed.
- If the value is not within this range, the device should be returned for calibration.
- Package the device with sufficient padding and enclose the completed "Repair Form."

Figure 22. Calibration Block

- If a calibration block is not purchased, there is always the option to complete a "Repair Form" to be return the device for calibration. Please call first for pricing.

Trouble-shooting

If any electrical component fails, the mechanical aspects of the device will still work but the screen will simply not display a read -out. This does not pose any risk to the user or the patient.

Table 4

Problem	Potential Concern	Action
User tries to put the attachment into the device incorrectly	Dovetail components will not permit the attachments to be inserted into the wrong side, i.e. large dovetail will not fit & small dovetail will fall out	Dovetail connection will only allow the components to attach as designed
User does not slide the attachment completely into the dovetail connection	Patient could have a skin pinch	User needs to push the attachment into the dovetail slot until the spring plunger engages
Spring plunger fails	Attachment will fail to lock into place; user should not use the device	Inspect integrity of spring plunger; user can return for repair or replacement
Uneven finish/burrs on the device	May scratch the skin	Return device for repair or replacement
No reading on the screen	Unit is not powered "on" or device is not charged	Turn device "on" and/or recharge device
Battery not charging	Battery, charging port, or charging wire failure	Try a different charging wire; Return device for repair or replacement
Crack in the screen	Read-out is not present or unable to be read	Return device for repair or replacement
Incorrect reading with challenge block	Inaccurate measure	Return device for recalibration
Device is dropped and/or there is a rattling noise inside device	Inaccurate measure	Assess with challenge device

Limited Warranty

Mobil-Aider™ is designed to perform in accordance with specifications provided by Therapeutic Articulations, LLC. The purchaser should consult the specifications prior to use.

The Mobil-Aider™ is warranted by Therapeutic Articulations, LLC to the original purchaser for a period of one (1) year from the date of purchase. The Mobil-Aider™ is warranted to be free from defects in materials and workmanship. The purchaser should contact Therapeutic Articulations, LLC by mail or email as follows to obtain a return authorization number:

Therapeutic Articulations, LLC
64 Bethel Church Road, Spring City, PA 19475 USA
dawn@mobil-aider.com
610.570.7153

Upon receipt of the Mobil-Aider™, Therapeutic Articulations, LLC will examine the device. If Therapeutic Articulations, LLC finds the device to be defective as a result of materials and/or workmanship, repair or replacement of the device will be at the expense of Therapeutic Articulations, LLC.

Please note, misuse, abuse, or unauthorized repairs/alternations of the device will void this warranty. Therapeutic Articulations, LLC will not be liable for commitments or agreements made by any of its employees, agents, or dealers not in compliance with the above stated warranty.

Therapeutic Articulations, LLC reserves the right to design or modify the device without incurring any liability whatsoever to any prior purchaser.

QUALITY MANAGEMENT SYSTEMS FORM

Return Authorization

Request for Return of Therapeutic Articulations Product

Requestor (Section 1)

NAME	
ADDRESS	
CITY	STATE
COUNTRY	ZIPCODE
PHONE	
SHIPPED VIA	SHIPPER TRACKING NO.
EXPECTED DATE OF PICKUP	EXPECTED DATE OF DELIVERY

Reason for request

- ☐ Malfunction Feedback Report # _____
- ☐ Ordered Wrong Part
- ☐ Other_____
- ☐ Provide Shipping Container For Returned Product

COMMENTS

Therapeutic Articulations Part Number	Returned Product Description	Serial / Lot Number	Replacement Needed
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No

RETURN REQUESTED BY	DATE	RA# ISSUED BY	DATE

Route to Receiving when Complete

Contract Manufacturer/Receiving (Section 2)

NAME & ADDRESS RECEIVED FROM (*IF DIFFERENT THAN ABOVE)*

RECEIVED BY	DATE

☐ Packing Slip Verified

Route to Therapeutic Articulations QA/RA when Complete