

Kiss Shoulder Pain Goodbye: Proper Technique – The Key to Preventing and Relieving Shoulder Pain

By Al Dodson

Shoulder pain is a common phenomenon in competitive swimming. There are many contributing factors. The most common cause is faulty technique. By analyzing the anatomical and mechanical principles involved in the execution of the four competitive strokes and utilizing drills to teach proper mechanics, “swimmers’ shoulder” can be prevented or relieved.

Technique Related Causes of Shoulder Pain

Six stroke elements are the most common causes of shoulder pain. Most swimmers with “swimmers’ shoulder” exhibit at least one of these causes. The six causes are often inter-related. A list of these major causes follows:

1. **Insufficient or Improper Body Roll** – freestylers and backstrokers who swim with an improper body position place too much emphasis upon using shoulder muscles as “prime movers” to provide positioning, propulsion, and recovery. Swimming in a position parallel to the water’s surface or with insufficient or imbalanced body roll places too much emphasis upon the shoulder muscles. It also forces the arm to recover on a plane that causes shoulder impingement. If proper hip and shoulder roll are utilized, these elements come from the major trunk muscles, therefore reducing stress upon the shoulder muscles.
2. **Excessive Medial Rotation During Recovery** – If the arm is rotated so that the back of the hand is rotated towards the body’s mid-line and the palm is facing away from the body, shoulder muscles constrict a “free recovery” and cause unnecessary muscle contraction and pain.
3. **Recovery with the Hand(s) Too Close to the Body** – If during the recovery phase in freestyle or butterfly, the hand is too close to the body, a “free recovery” is again, constricted. The hand should be swung away from the body with minimal muscle contraction.
4. **Applying Too Direct or Too Much Force During the “Catch” Phase of the Stroke** – If during the “catch” phase of the stroke, too straight or too strong a force is used, the head of the humerus is rotated into the deltoid muscle and causes tendonitis, and/or the scapula is pushed against the rotator cuff muscles, causing pain or possible tissue damage. The “catch” phase of the stroke should utilize an out-and-downward scull with minimal force.
5. **Collapsing the Elbow Across the Body During the Underwater Propulsive Phase of the Stroke** – If the elbow is dropped during the propulsive phase of the stroke, the head of the humerus is, again, rotated into the deltoid causing friction and tendonitis, and/or the scapula is pushed against the rotator cuff muscles, causing pain or possible tissue damage. Maintaining the elbow over or outside the hand will prevent this rotation and friction, hence preventing or relieving pain.
6. **Lack of Stroke Length** – Strokes that are shorter than what is required cause too many contractions and therefore excessive muscle fatigue and pain. If a swimmer uses two extra strokes per length in a short course pool, it means that eight extra strokes are used per 100 yards/meters and four hundred eighty additional strokes per 6000 yard/meter workout, hence much more muscle fatigue which can cause pain.

Principles That Should Be Followed in Using Stroke Development and Correction Drills to Prevent or Relieve Shoulder Pain

Because stroke development and correction drills are essential to teaching stroke mechanics that will prevent or relieve shoulder pain, the following principles must be followed. These principles include:

- Use only drills that utilize sound stroke principles
- Avoid drills that may lead to other stroke flaws or possible causes of injury
- Accentuate proper execution of drills – don’t allow swimmers to “just go through the motions” – drills can build improper motor patterns as easily as proper technique.

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- Use various drills to build, to refine, or reinforce different stroke phases, but remember drills should be taught "as another stroke"- drill perfection is required to teach perfect technique.
- **Emphasize the feel** of each stroke phase being taught or improved – teaching aids such as paddles, fins, and surgical tubing may help to improve sensory input.
- Increase swimmer interest and focus by “inventing” new drills, or allowing swimmers to “invent” drills themselves – remember these drills need to utilize sound stroke principles that do not lead to stroke flaws or injuries.
- Repeat and refine drills on an ongoing basis

Teaching Strategies for Developing Stroke Mechanics That Prevent Or Relieve Shoulder Pain

Teaching proper stroke mechanics always requires precision, however, building motor patterns that avoid or correct the six major causes of shoulder pain requires an even more precise approach. This is particularly true when working with an individual who already has a history of shoulder problems.

The first step is to analyze the skills involved in efficient pain-free mechanics. The result of this analysis is to break down the stroke into small steps that when combined will yield an efficient stroke free from any of the technique-oriented causes of pain.

Next, it is necessary to develop strategies to teach these small steps and then combine them into complete skills. Often times, attempts to teach neuro-muscular skills and motor memory skip the most elementary teaching steps. This should never happen when avoiding or addressing shoulder pain. A progression of these steps should include:

1. **Movement of a Body Part Through the Desired Movement** – only by precisely manipulating the swimmer through the desired movement can the coach guarantee the precise result. This relates to both pieces or entire skills, and can be used in and out of the water.
2. **Pairing Moving the Body or Body Part with Language** – a verbal description while moving the swimmer through the desired skill will help to present the language that the coach can use later to present verbal cues.
3. **Use of a Physical Prompt or Cue** – the coach uses a tap or very brief physical direction to help the athlete complete the desired movement. Often this is an effective method of correcting faulty mechanics with minimal input, and also can be used in and out of the water.
4. **Presenting Resistance to the Desired Movement** – resisting the proper movement helps to increase sensory input. The first step in “resistive sensory input” is the coach or another team member holding the body or body part and resisting any movement. Next the coach or partner, reduces the amount of pressure so the swimmer can complete the desired motion against reduced resistance. Later, teaching aids such as stretch cords, surgical tubing, or paddles may be used to present resistance and improve sensory input. It is important to realize this applied resistance is not meant to be used as a strength building exercise but to improve the “feel” of the stroke. Again, pairing language to this strategy will add to success.
5. **Demonstration** – Total skills or small segments can be shown by the coach or another swimmer (in person or on video-tape, etc.). It is important that the demonstration meets or exceeds the performance level being taught. Often on-deck demonstration is superior to in-water performance.
6. **Verbal Explanation** – oral description is the most difficult form of teaching a motor skill. When teaching through the use of language, it is best to pair the verbal explanation with assisted movement, resistive movement, physical cues, or demonstration.

The goal of all of these strategies should always be teaching the “feel” of proper stroke technique. Sensory and motor memory are essential to the execution of proper technique, and hence necessary to prevent and relieve shoulder pain.

Stroke Specific Details: What to Avoid, What to Do, Drills Used to Develop Pain-Free Mechanics

Even though all strokes may share common causes of shoulder pain, each stroke presents its own unique traits and therefore requires its own approaches and remedies.

Freestyle –

What to Avoid:

1. A stroke that is too flat, a stroke with insufficient body roll, or an imbalanced hip and shoulder roll – this places too much of an emphasis on the use of shoulder muscles as prime movers and also forces the arm through the plane that causes impingement injury.
2. A recovery that uses excessive medial rotation during the recovery phase of the stroke – this recovery requires excessive muscle contraction and constriction of the shoulder joint.
3. A recovery with the hand(s) too close to the body or with too much elbow flexion – this form also restricts a “free recovery”.
4. A catch that uses too straight or too strong an application of force – this results in the head of the humerus rotating into the deltoid muscles, causing tendonitis, and/or pushes the scapula against the rotator cuff muscles, causing pain or possible tissue damage.
5. Dropping the elbow during the propulsive phase of the stroke – this action also causes the head of the humerus to rotate into the deltoids, therefore causing tendonitis, and/or pushes the scapula against the rotator cuff muscles, causing pain or possible tissue damage.
6. A stroke that doesn't utilize maximum distance per stroke - an excessive number of strokes causes much more muscle fatigue and pain.
7. Drills that lead to faulty pain-causing technique – two commonly-used drills come to mind. They are the “thumb-line” drill and the “finger-tip drag” drill. They both are used to teach a high-elbow recovery, but lead to stroke flaws that may contribute to shoulder injury. The “thumb line” drill causes excessive medial rotation, excessive elbow flexion, a hand-too-close-to-the body recovery, and limited stroke length. The “finger-tip drag”, while not as limiting as the “thumb-line” drill, still limits proper body roll, causes the hand to be recovered too close to the body, utilizes too much elbow flexion, and limits stroke length. After a complete analysis, drills that contribute to stroke flaws should be eliminated.

What to Do:

1. Use a balanced hip and shoulder roll – an up-on-the-side position that utilizes a balanced body roll, places the emphasis of positioning, propulsion, and recovery upon the major trunk muscles, not the smaller, weaker muscles of the shoulder. It also prevents the movement of the upper arm through the position that causes shoulder impingement. A proper, balanced rotation may be the most important stroke component in the prevention and relief of shoulder pain.
2. Use an elbow-lift-hand-away-from-the-body start to the recovery phase of the stroke. The initial elbow-first lift from the water, not only helps with propulsion, but also helps to avoid shoulder pain. This lift helps to avoid shoulder impingement. It is also essential that elbow flexion approximates 135° or that the forearm and hand not exceed 45° to the water's surface. The hand should stay lower than the elbow, but be kept as far above the trunk and away from the body as possible. The palm of the hand should face the body at this point to avoid any medial rotation.
3. Swing the hand from the “elbow lift” position with the back of the hand facing forward and the palm of the hand facing backward – This swing will minimize excessive muscle contraction and medial rotation, promoting a “free recovery”.

4. After swinging the hand, there should be an extension of the elbow and shoulder joints. The elbow joint should be extended as far as it can and still remain higher than the elbow. This extension encourages the greatest stroke length.
5. Finger-tips should enter the water first with the hand rotated no more than 45°. This position not only prevents excessive medial rotation but promotes greater distance per stroke.
6. Utilize an outward-and-downward scull with minimal force during the “catch” phase of the stroke – This stroke phase should be looked upon as a positioning phase only.
7. Always keep the elbow high or outside the hand during the propulsion phase of the stroke – This will prevent the head of the humerus from rotating into the muscles of the shoulder and causing tendonitis, and/or the scapula from pressing on the rotator cuff and causing pain or possible tissue damage.
8. Always concentrate on distance per stroke – the fewer strokes taken, the less muscle fatigue, therefore less pain.

Drills That Develop Pain-Free Freestyle Mechanics:

1. Compare and contrast proper and improper positions and movements to the swimmers – Move the arm(s) of the swimmer when the swimmer is in a flat position and an up-on-the side position, a recovery using excessive medial rotation and a recovery with no rotation, a recovery with hands too close to the body with too much elbow flexion and a hands-away-from-the body and a free-swinging recovery, a too straight and forceful stroke catch with a relaxed sculling action, and finally, dropping the elbow across the body during the propulsion versus keeping the elbow high or outside the hand during propulsion. During the comparison and contrast, the swimmer should be told to focus on the feel of shoulder joint and muscle tension versus feeling of free movement. These comparisons and contrasts help to demonstrate the differences to the swimmer and help to teach sensory and motor memory so later the athlete can help to monitor his/her own stroke mechanics.
2. On-Deck body positioning - lying on a bench on the stomach, the swimmer extends his/her arm as far forward as he/she can without touching his/her elbow to the bench. He/she then rolls onto his/her side and extends his/her arm as above. Repeat on other side. The purpose of this exercise is to demonstrate a proper, and balanced up-on –the-side body position and increased length of the reach when “up-on-your-side”. An expansion of this exercise may include the use the resistance of a very light surgical tube to increase kinesthetic awareness.
3. Side-kicking drills -
 - Face-to-side – lying on the side with the ear rested on the water, the deeper arm fully extended, and the upper arm at the side with the hand on the thigh. Emphasis should be placed on maintaining the body at 90° to the water’s surface. Emphasize that the shoulder, hip, side of knees, and side of ankles should be pointed directly at the ceiling. Swimmers should also, be coached to feel a stretch at the elbow, shoulder, hip, knee, and ankle joint. This drill helps to teach the “up-on-the-side position”, body roll, and streamlining. All these components assist in preventing and relieving shoulder pain and increasing stroke length.
 - Face-toward-the-bottom-of the pool – this drill is done the same way as above except the face is pointed directly at the pool bottom. Again, this drill assists in teaching a streamline body position and the “up-on-the-side body position”, but also helps to teach rotating the shoulders, trunk, and hips around the body’s central axis while maintaining a stationary head position. This rotation is essential to pain prevention, relief, and stroke length.

4. **Elbow-lift drills** –
 - On-deck – lying on the deck or on a bench, the swimmer should assume the up-on-the-side position. He/she should then lift the elbow as if dragging the hand from the water. The hand should move above the trunk, away from the body. The angle of the elbow should not be less than 135° (less than that would cause excessive flexion and a more constricted shoulder movement). The hand and elbow should then be returned to the starting position and the drill be repeated several times on both sides.
 - Face-to-side – the swimmer should execute the face-to-side side-kicking drill adding the elbow lift drill executed on the deck. It is important that the palm of the hand face the body during this drill to avoid excessive medial rotation. The drill should be repeated on both sides.
 - Face-toward-the-bottom-of-the-pool – the swimmer should execute the face-toward-the-bottom-of-the-pool side kicking drill, adding the elbow lift as executed above. Again excessive flexion and all medial rotation must be avoided. The drill should be repeated on both sides to help ensure proper balance.
5. **Front-rear-finger-tip-touches** – the swimmer assumes the up-on-the-side position with one hand back. He/she then lifts the elbow and swings the hand with the palm facing backwards. As the hand moves forward, the body rotates so that when the hand reaches the front of the front of the stroke, the opposite hip and shoulder are facing the ceiling or sky. Only the finger tips touch the water's surface. The hand is then swung backward until the finger tips touch at the rear of the stroke. Again the hips and shoulders rotate in unison. The elbow should remain high throughout the drill. The movement should be repeated several times on both sides. It may be best to teach this drill on the deck or on a bench first. This drill assists in teaching the initial elbow lift, the palm back free recovery, and proper trunk rotation.
6. **Kick and roll drill** – this drill is initiated by assuming the same position as described in the side-kicking drills. The swimmer kicks 6 kicks on one side (this number can either be expanded or contracted) and then pulls with the extended arm and recovers with the upper arm and the swimmer rotates to the other side, kicks 6 kicks and repeats the drill. This can be done with the face to the side or toward the bottom of the pool. This drill helps to teach stroke balance, rotation and the "up-on-the side position" which are essential to preventing and relieving pain as well as teaching stroke length.
7. **Freestyle hesitation drill** – another recovery drill is completed one arm at a time. The swimmer does a one arm freestyle drill with the following adaptation: when the arm recovery reaches a position even with the shoulder, the swimmer breathes to that side and stops the recovery. He/she then checks to ensure that the elbow is high, the hand is away from the body, and there is no medial rotation. This drill helps eliminate a hand-too-close-too close-to-the-body recovery, excessive elbow flexion, and medial rotation during the recovery.
8. **Front sculling drills** - these drills incorporate a pull buoy between the legs. The swimmer lies in the water with either the head up or with the face pointed at the bottom of the pool, and the arms extended in front of the shoulders with the hands angled slightly outward. Without moving the elbow, rotate the hand so the finger tips face directly towards the bottom of the pool, then move the hand and forearm backward until they reach the elbow which is held high, rotate the hand inward and forward until it reaches the starting point. Emphasize pressure against the hands during rotation. This drill can be done with one hand at a time, two hands at a time, and/or alternating hands. The purpose is to teach the initial sculling action of the stroke "catch" without exerting excess force, thus preventing the head of the humerus from rotating into the muscles of the shoulder and causing tendonitis, and/or the scapula being pushed against the rotator cuff muscles, causing pain or possible tissue damage.
9. **Combined rear sculling and hip rotation drills** – the swimmer lies on the stomach with either the head up or with the face pointed at the bottom of the pool. The hands should be held slightly below and behind chest level with finger tips facing the bottom of the pool and the palms of the hands pointed slightly outward on a diagonal. Simultaneously, the hand is sculled outward and upward past the hips while the hips rotate to 90°

10. **One arm drills** - one arm drills can be used to isolate different stroke phases such as rotation, long recovery, initial stroke setup or "catch", different sweeps of the hands and smooth transition between stroke phases. They can also be used with a stroke count to measure stroke length. All of these components are important to prevention and relief of shoulder pain.
11. **2/2/4 drills** - again, 2/2/4 drills can be used to isolate and emphasize different stroke phases, but also is an excellent transition between isolated parts and full stroke. The swimmer completes two strokes with one arm, then two strokes with the other arm, and then four full strokes. One of the primary principles of prevention or relief of pain should be emphasized and feed back address that area.
12. **Over-reach catch-up drills** - One hand is held stationary in an extended position while the other arm completes an entire stroke cycle until it reaches beyond the extended, stationary arm. The extended arm then completes a stroke cycle while the other arm remains extended and stationary. It is important to emphasize reaching beyond the stationary arm if stroke length is to be improved. Fewer strokes result in fewer muscle contractions and less fatigue and pain.
13. **Training drills designed to reduce the number of strokes per length**
 - 3 x 25 strokes per length drills – the set consists of a series of short course 25's (it can be adapted to 50 meters, if only a long course is available) done in the following manner: The first 25 of each set is at a very relaxed pace, counting the number of strokes taken, the second swim is at 200 pace, attempting to maintain the same number of strokes, and the third swim is an all-out sprint still attempting to hold the same number of strokes. The goal is to increase the stroke rate without decreasing stroke length.
 - Modified Mini-Max or descending Mini-Max sets – the next step can incorporate a series of four descending 50's utilizing the concepts used in Bill Sweetenham's Mini-Max sets. Swimmers utilize one or more sets of descending 50's. Swimmers count the number of strokes per 50 and add them to their time. This should be done for each descending repeat. At first, the goal should be a descending total, later the swimmer should maintain the same stroke count but descend times and total, and last swimmers should descend times, stroke counts, and totals. In the beginning, the first repeat should be very easy and the series descended to an all out sprint. The contrast in descending assists in teaching the concept of increasing speed while maintaining or reducing stroke count. As swimmers become more proficient, the initial time of each set can be faster so there will be less contrast between the first and fourth swim of each set. Various refinements and variations can include time and rate goals as mentioned in the drill above can be used. Distances can also be varied. Using Mini-Max 25's can be used with younger, less experienced swimmers and to provide more feedback. 100's or 200's can be used to teach maintaining constant stroke length over greater distances.
 - Mini-Max 50's – Bill Sweetenham, long-time coach and current National Performance Director of swimming in Great Britain, developed the next set. Each set should include 4 – 6 x 50 swims. Count your strokes on your first 50, accurately count the number of strokes taken during the 50, and add the number of strokes to the time. If you take 30 strokes and do a :30, your total is 60. Attempt to reduce your total by going faster with the same number of strokes, doing the same time with fewer strokes, or go faster with fewer strokes. Continue for the entire set(s). Fewer strokes is good, faster is great, and faster with fewer strokes is best.

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Backstroke –

What to Avoid:

1. **A stroke that is too flat, a stroke with insufficient body roll, or an imbalanced hip and shoulder roll** - this places too much of an emphasis on the use of shoulder muscles as prime movers and also places an undue restriction of the pushing down motion of the entry to reach the “catch” of the stroke. This is the most common cause of shoulder pain in backstroke.
2. **A recovery that swings the arm laterally instead of vertically** – if the hand is swung laterally, and parallel to the water, the shoulder and hip are rotated in the wrong direction.
3. **A catch that uses too strong an application of force** – similar to freestyle, if a strong force is used during the catch phase of the stroke, the head of the humerus rotates into the deltoid muscles and causes tendonitis, and/or the scapula pushes against the rotator cuff muscles, causing pain or possible tissue damage.
4. **Leading with the elbow during the propulsive phases of the stroke** – leading with the elbow also causes the humerus to rotate the humerus into the shoulder muscles, and/or pushes the scapula against the rotator cuff muscles, causing pain or possible tissue damage.
5. **A recovery with the little finger leading as the hand exits the water or too soon in the stroke** – this little-finger lead causes excessive medial rotation and constriction of the shoulder joint during recovery.
6. **Drills that lead to faulty, pain-causing technique** – the most common used drill that may lead to shoulder pain is the two arm recovery drill. Although this may lead to a vertical recovery and a behind the shoulder entry, it leads to too flat a recovery without hip and shoulder rotation.

What to Do:

1. **Use a balanced hip and shoulder roll** – an up-on-the-side position that utilizes a balanced body roll, places the emphasis of positioning, propulsion, and recovery upon the major trunk muscles, not the smaller, weaker muscles of the shoulder. It also prevents an overly-extended shoulder during the downward motion following the entry to reach the “catch” of the stroke. Avoiding this hyperextension of the shoulder helps to avoid the major cause of shoulder pain during swimming backstroke.
2. **Use a vertical recovery directly in front of the shoulder** – this vertical recovery assists and allows for a free backstroke recovery and helps establish an up on the side position.
3. **Lead with a hip and shoulder rotation during the recovery** – the swimmer should think lead with the hip and shoulder and then the hand during the recovery.
4. **The thumb should lead the hand out of the water** – this thumb lead avoids medial rotation too early in the stroke and therefore reduces restricting a free recovery.
5. **Delay rotating the hand to the “little-finger-leading” position until past the vertical** – this delay utilizes the trunk roll to minimize constriction of the shoulder joint.
6. **Use a downward and outward scull with minimal force at the front of the stroke to establish the “catch”** – this stroke phase should be looked upon as a positioning phase only.
7. **Maintain a right angle at the elbow or a hand-ahead-of-the-elbow position during the propulsive phase of the stroke** – these positions prevent the humerus from rotating into the deltoids, and/or the scapula being pushed against the rotator cuff muscles.
8. **Always concentrate on distance per stroke** – the fewer strokes taken, the less muscle fatigue, therefore less pain.

Drills That Develop Pain-Free Backstroke Mechanics:

1. **Compare and contrast proper and improper positions and movements to the swimmer** – move the arm(s) of the swimmer when in a flat position and an up-on-the-side position, a lateral recovery and a vertical recovery, a recovery with excessive or too early medial rotation and a recovery that delays medial rotation until it is aided by hip and shoulder rotation, a too straight or too forceful catch and a relaxed sculling and finally, a pull with the elbow leading the hand and a pull maintaining a right angle or a hand leading the elbow pull. The swimmer should be directed to focus on the feel of the shoulder joint. The comparisons and contrasts help to demonstrate the differences to the swimmer and help to teach sensory and motor memory, so the athlete can help to monitor his/her own stroke mechanics.
2. **On-deck body positioning** - the purpose of this exercise is to demonstrate a proper and balanced up-on-the-side body position and a pain-free downward push and catch.
3. **Backstroke side-kicking drills** – lying on the side with the face pointed straight up towards the ceiling or sky, the deeper arm fully extended, and the other arm arm at the side with the hand on the thigh. Emphasis should be placed on maintaining the body at 90° to the water's surface. Emphasize that the shoulder, hip, side of knees, and side of ankles should be pointed directly at the ceiling. Swimmers should also, be coached to feel a stretch at the elbow, shoulder, hip, knee, and ankle joint. This drill helps to teach the “up-on-the-side position”, body roll, and streamlining. All these components assist in preventing and relieving shoulder pain and increasing stroke length.
4. **Up-down recovery drill** – lying on the back, the swimmer begins to rotate the hip and shoulder in unison and lifts the hand with the thumb leading. The hand continues to a position perpendicular to the surface of the water and the finger tips pointing directly towards the ceiling or the sky. The hand is then brought back to the starting position as the opposite hip and shoulder rotate while that hand remains at the side. Repeat with both arms. The purpose of this drill is to teach simultaneous hip and shoulder roll and a proper vertical recovery in front of the shoulder. Note that the thumb leads throughout the up phase of the drill.
5. **Two arm up-down recovery drill** – this drill resembles the up-down recovery drill, however when the first hand is returned to the starting position, the same hip and shoulder rotation and hand lift is repeated on the other side. This should be repeated on alternate sides. Again the purpose of this drill is to teach simultaneous hip and shoulder roll and a proper vertical recovery.
6. **Up-down-up-pull drill** – this drill begins in the same way as the up-down recovery drill. The hip and shoulder roll in unison, the hand, with the thumb leading is brought to 90° to the water's surface and then returned to the starting position but then is again lifted vertically with the thumb leading. After the hand passes the perpendicular and the trunk begins to roll downward, the hand begins to rotate so that the little finger leads the hand into the water and executes an underwater pull. The up-down-up-pull action should be repeated on both sides. This drill teaches hip and shoulder roll, a vertical recovery, and a delayed medial rotation of the hand and arm during the recovery.
7. **Backstroke front sculling drill** – the swimmer begins with the backstroke side-kicking drill, with the deeper hand he/she pushes downward with a straight elbow until it reaches a depth of 12 – 18 inches, he/she completes a sculling action until the hand reaches a 90° angle at the elbow joint. The hand is then rotated and pushed forward underwater to the starting point. The drill should be repeated on both sides. This drill is used to teach the initial sculling action of the stroke catch without exerting excess force, thus preventing the head of the humerus from rotating into the muscles of the shoulder and causing tendonitis, and/or pushing the scapula against the rotator cuff muscles, causing pain or possible tissue damage.
8. **Backstroke combined rear sculling and hip rotation drill** – the swimmer should begin with a backstroke side-kicking drill with the deeper arm held at 90° to the elbow. He/she should then complete a downward sculling action until the hand is approximately 12 inches away from the body and 12 – 18 inches deep. The hip then should immediately begin an upward rotation. The hand is then returned underwater to the starting position and the action repeated. The drill assists in teaching the proper hip and shoulder roll at the completion of the propulsive phase of the stroke.

9. **One arm backstroke drills** - one arm drills can be used to isolate different stroke phases such as rotation, vertical recovery, initial stroke setup or “catch”, different sweeps of the hands and smooth transition between stroke phases. They can also be used with a stroke count to measure stroke length. All of which are important to prevention and relief of shoulder pain.
10. **2/2/4 drills** - again, 2/2/4 drills can be used to isolate and emphasize different stroke phases, but also is an excellent transition between isolated parts and a full stroke. The swimmer completes two strokes with one arm, then two strokes with the other arm, and then four full strokes. One of the primary principles of prevention or relief of pain should be emphasized and feed back address that area.
11. **Training drills designed to reduce the number of strokes per length –**
 - 3 x 25 strokes per length drills – the set consists of a series of short course 25’s (it can be adapted to 50 meters, if only a long course is available) done in the following manner: The first 25 of each set is at a very relaxed pace, counting the number of strokes taken, the second swim is at 200 pace, attempting to maintain the same number of strokes, and the third swim is an all-out sprint still attempting to hold the same number of strokes. The goal is to increase the stroke rate without decreasing stroke length.
 - Modified Mini-Max or descending Mini-Max sets – the next step can incorporate a series of four descending 50’s utilizing the concepts used in Bill Sweetenham’s Mini-Max sets. Swimmers utilize one or more sets of descending 50’s. Swimmers count the number of strokes per 50 and add them to their time. This should be done for each descending repeat. At first, the goal should be a descending total, later the swimmer should maintain the same stroke count but descend times and total, and last swimmers should descend times, stroke counts, and totals. In the beginning, the first repeat should be very easy and the series descended to an all out sprint. The contrast in descending assists in teaching the concept of increasing speed while maintaining or reducing stroke count. As swimmers become more proficient, the initial time of each set can be faster so there will be less contrast between the first and fourth swim of each set. Various refinements and variations can include time and rate goals as mentioned in the drill above can be used. Distances can also be varied. Using Mini-Max 25’s can be used with younger, less experienced swimmers and to provide more feedback. 100’s or 200’s can be used to teach maintaining constant stroke length over greater distances.
 - Mini-Max 50’s – Bill Sweetenham, long-time coach and current National Performance Director of swimming in Great Britain, developed the next set. Each set should include 4 – 6 x 50 swims. Count your strokes on your first 50, accurately count the number of strokes taken during the 50, and add the number of strokes to the time. If you take 30 strokes and do a :30, your total is 60. Attempt to reduce your total by going faster with the same number of strokes, doing the same time with fewer strokes, or go faster with fewer strokes. Continue for the entire set(s). Fewer strokes is good, faster is great, and faster with fewer strokes is best.

Butterfly - What to Avoid:

1. **A stroke that is too flat** – this places too much emphasis on the use of shoulder muscles rather than being assisted by the kick and body position.
2. **Hands exiting the water with the palms facing upwards** – this requires medial rotation that prevents a free-flowing recovery and limits the use of momentum.
3. **A recovery that uses excessive medial rotation during the recovery phase of the stroke** – this recovery requires excessive muscle contraction and constriction of the shoulder joint.
4. **A recovery with the hands too close to the body or with too much elbow flexion** – this form also restricts a “free recovery”.
5. **A catch that uses too straight or too strong an application of force** – this results in the head of the humerus rotating into the deltoid muscles, causing tendonitis, and/or pushes the scapula against the rotator cuff muscles, causing pain or possible tissue damage.

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6. **Dropping the elbow during the propulsive phase of the stroke** – this action also causes the head of the humerus to rotate into the deloids, therefore causing tendonitis, and/or pushes the scapula against the rotator cuff muscles, causing pain or possible tissue damage.
7. **A stroke that doesn't utilize maximum distance per stroke** - an excessive number of strokes causes much more muscle fatigue and pain.
8. **Stopping the hands at either the front or rear of the stroke** – if the hands are stopped, it eliminates the use of momentum and requires excessive muscle contraction to overcome resting inertia.
9. **Breathing too late in the stroke** – late breathing causes the hips to be compressed, so the results of body undulation will be limited, thus placing more responsibility for propulsion on the shoulder muscles.
10. **A stroke that utilizes a straight back push at the rear of the propulsive phase of the stroke** – pushing straight back requires the shoulder muscles to exert too great a contraction to initiate the recovery and also causes the head of the humerus to rotate into the deltoid muscles.
11. **Drills that lead to faulty pain-causing technique** – two drills that come to mind are the “butterfly kick with freestyle pull” drill and the “butterfly finish drill with palms facing up” drill. This first drill, while effective in teaching the kick, it encourages a recovery with hands too close to the body. The second drill teaches a constricted medial rotation at the beginning of the recovery.

What to Do:

1. **Use a flexible kick and undulating body position** – these actions will assist in propulsion and recovery, therefore, taking pressure off the shoulder joints and muscles.
2. **Use a little-finger-first exit of the hands from the water** – by leading with the little fingers first with the palms facing the body, the swimmer eliminates or minimizes medial rotation during recovery. This assists in utilizing a “free recovery”.
3. **Use momentum from the rear sculling action of the propulsive phase to initiate the recovery** – an explosive rear sculling action of the underwater pull can utilize moving inertia to reduce muscle contraction during recovery.
4. **Use a recovery with a relaxed elbow, but with the hands away from the body** – the arms should be relaxed with the hands swung away from the body, using as little muscle contraction as possible.
5. **Use an outward-and-downward scull with minimal force during the catch phase of the stroke** – this stroke phase should be looked upon as a positioning phase only.
6. **Always keep the elbow high or outside the hand during the propulsive phase the stroke except the rear scull** – this will prevent the head of the humerus from rotating into the muscles of the shoulder and causing tendonitis, and/or the scapula pressing against the rotator cuff muscles, causing pain or possible tissue damage.
7. **Use a continuous motion of both arms and the kick** – this continuous action assists in using momentum and minimizing muscle contraction.
8. **Initiate breathing early enough in the stroke so that the hips are not compressed** – breathing at the proper time encourages body undulation and reduces contraction of the shoulder muscles.
9. **Use an outward-and-upward scull at the rear of the stroke** – not only is this a must for maximum propulsion, it also assists in maximizing a muscle-free recovery.
10. **Use an explosive movement at the rear of the stroke** – this helps to initiate the recovery while eliminating excessive muscle contraction.
11. **Always concentrate on distance per stroke** – the fewer strokes taken, the less muscle fatigue, therefore, less pain.

Drills That Develop Pain-Free Butterfly Mechanics:

1. **Compare and contrast proper and improper positions and movements to the swimmer** – move the swimmers arms through a recovery with excessive medial rotation with a recovery with no rotation, a recovery with hands too close to the body with a free swinging wide recovery, a too straight and forceful catch and a relaxed sculling action, dropping the elbows across the body during propulsion versus keeping the elbow above or outside the elbow except during the rear scull and a straight back push and recovery and a rear scull and recovery. During the comparison and contrasts, the swimmer should be told to focus on the feel of the shoulder joints and muscles. These comparisons and contrasts help to demonstrate the differences to the swimmer and help to teach sensory and motor memory, so later the athlete can help monitor his/her own stroke mechanics.
2. **Various butterfly kicking drills** – underwater kicking, side kicking, kicking on the back, and 4/2 kicking drills all help to teach propulsive butterfly kicking and body undulation that are important to relieving stress on the shoulder joints and muscles.
3. **One arm recovery drills** – these drills should emphasize the little finger of the hand exiting the water first and then swinging the arm away from the body with the palm of the hand facing the water's surface. This teaches a relaxed, away from the body recovery with no medial rotation.
4. **2/2/2 or 2/2/4 recovery drills** – these drills begin with two one arm strokes with one arm, then two one arm strokes with the other arm, and then followed by either two or four full strokes. Again, little fingers exiting the water first, arms swung away from the body, and the palms of the hands facing the water's surface should all be emphasized.
5. **Front sculling drills** – these drills may use either a pull buoy or a butterfly kick. They should utilize the same technique that is used in the freestyle front sculling drills. The purpose of this drill is to teach the initial sculling action of the stroke catch without exerting excessive force, thus preventing the head of the humerus from rotating into the muscles of the shoulder and causing tendonitis, and/or pushing the scapula against the rotator cuff muscles, causing pain or possible tissue damage.
6. **One arm drills** – in addition to one arm drills that are used to teach proper recovery, the same drills can be used to teach the front sculling, action, the middle inward sweep of the hands with high elbows or with the elbows outside the hands, or the rear sculling action.
7. **2/2/2 or 2/2/4 drills** – these drills can also be used to teach the front sculling action, the middle inward sweep, or the rear sculling action. In addition, 2/2/2 and 2/2/4 drills act as an excellent transition between drills and whole strokes.
8. **Rear sculling drill** – the hands start at the chest level and are sculled outward and upward and then returned to the starting point underwater. This drill helps to teach the explosive rear of the butterfly stroke.
9. **Combined rear sculling and little finger lift** – the rear sculling drill is executed and then the little fingers are brought out of the water, then the hands are brought back into the water and recovered to the starting position underwater. This drill helps to teach both the rear sculling action and the transition between the propulsive and recovery phases of the stroke.

10. Training drills designed to reduce the number of strokes per length –

- 3 x 25 strokes per length drills – the set consists of a series of short course 25's (it can be adapted to 50 meters, if only a long course is available) done in the following manner: The first 25 of each set is at a very relaxed pace, counting the number of strokes taken, the second swim is at 200 pace, attempting to maintain the same number of strokes, and the third swim is an all-out sprint still attempting to hold the same number of strokes. The goal is to increase the stroke rate without decreasing stroke length.
- Modified Mini-Max or descending Mini-Max sets – the next step can incorporate a series of four descending 50's utilizing the concepts used in Bill Sweetenham's Mini-Max sets. Swimmers utilize one or more sets of descending 50's. Swimmers count the number of strokes per 50 and add them to their time. This should be done for each descending repeat. At first, the goal should be a descending total, later the swimmer should maintain the same stroke count but descend times and total, and last swimmers should descend times, stroke counts, and totals. In the beginning, the first repeat should be very easy and the series descended to an all out sprint. The contrast in descending assists in teaching the concept of increasing speed while maintaining or reducing stroke count. As swimmers become more proficient, the initial time of each set can be faster so there will be less contrast between the first and fourth swim of each set. Various refinements and variations can include time and rate goals as mentioned in the drill above can be used. Distances can also be varied. Using Mini-Max 25's can be used with younger, less experienced swimmers and to provide more feedback. 100's or 200's can be used to teach maintaining constant stroke length over greater distances.
- Mini-Max 50's – Bill Sweetenham, long-time coach and current National Performance Director of swimming in Great Britain, developed the next set. Each set should include 4 – 6 x 50 swims. Count your strokes on your first 50, accurately count the number of strokes taken during the 50, and add the number of strokes to the time. If you take 30 strokes and do a :30, your total is 60. Attempt to reduce your total by going faster with the same number of strokes, doing the same time with fewer strokes, or go faster with fewer strokes. Continue for the entire set(s). Fewer strokes is good, faster is great, and faster with fewer strokes is best.

Breaststroke –

What to Avoid:

1. A stroke that utilizes too much force during the outswEEP of the hands at the front of the stroke – a too forceful front scull can cause shoulder tendonitis, and/or pushes the scapula against the rotator cuff muscles, causing pain or possible tissue damage.
2. Collapsing the elbows too soon during the insweep of the hands – the hands should lead the elbows on the initial part of the inward sculling action of the pull.
3. Lack of stroke length – an excessive number of strokes causes more muscle fatigue and pain.

What to Do:

1. Utilize an outward-and-downward scull with minimal force during the outswEEP of the stroke – this stroke phase should be looked upon as a positioning phase only.
2. Have the hands lead the elbows on the first phase of the back and inward scull – the elbows should be brought together into a streamline position only at the end of the insweep.
3. Always concentrate on distance per stroke – the fewer the strokes taken, the less muscle fatigue, therefore, less pain.

Drills That Develop Pain-Free Breaststroke Mechanics:

1. **Front sculling drills** – with the hands fully extended, scull the hands out with the hands facing outward on a diagonal and then return them to the starting position without bending the elbows. This drill teaches a relaxed sculling action at the front of the stroke.
2. **Inward sculling drill** – this drill begins with the hands at the widest part of the stroke. The hands are then sculled inward with the elbows high and outside the hands. This action prevents the elbows collapsing too soon and causing the head of the humerus to rotate into the deltoids, causing tendonitis, and/or pushing the scapula against the rotator cuff muscles, causing pain or possible tissue damage.
3. **Training drills designed to reduce the number of strokes per length** –
 - 3 x 25 strokes per length drills – the set consists of a series of short course 25's (it can be adapted to 50 meters, if only a long course is available) done in the following manner: The first 25 of each set is at a very relaxed pace, counting the number of strokes taken, the second swim is at 200 pace, attempting to maintain the same number of strokes, and the third swim is an all-out sprint still attempting to hold the same number of strokes. The goal is to increase the stroke rate without decreasing stroke length.
 - Modified Mini-Max or descending Mini-Max sets – the next step can incorporate a series of four descending 50's utilizing the concepts used in Bill Sweetenham's Mini-Max sets. Swimmers utilize one or more sets of descending 50's. Swimmers count the number of strokes per 50 and add them to their time. This should be done for each descending repeat. At first, the goal should be a descending total, later the swimmer should maintain the same stroke count but descend times and total, and last swimmers should descend times, stroke counts, and totals. In the beginning, the first repeat should be very easy and the series descended to an all out sprint. The contrast in descending assists in teaching the concept of increasing speed while maintaining or reducing stroke count. As swimmers become more proficient, the initial time of each set can be faster so there will be less contrast between the first and fourth swim of each set. Various refinements and variations can include time and rate goals as mentioned in the drill above can be used. Distances can also be varied. Using Mini-Max 25's can be used with younger, less experienced swimmers and to provide more feedback. 100's or 200's can be used to teach maintaining constant stroke length over greater distances.
 - Mini-Max 50's – Bill Sweetenham, long-time coach and current National Performance Director of swimming in Great Britain, developed the next set. Each set should include 4 – 6 x 50 swims. Count your strokes on your first 50, accurately count the number of strokes taken during the 50, and add the number of strokes to the time. If you take 30 strokes and do a :30, your total is 60. Attempt to reduce your total by going faster with the same number of strokes, doing the same time with fewer strokes, or go faster with fewer strokes. Continue for the entire set(s). Fewer strokes is good, faster is great, and faster with fewer strokes is best.

Summary and Conclusion

There are many contributing factors for shoulder pain in swimmers, and numerous preventative measures and remedies. In most cases, if proper stroke technique is used, pain can be avoided or relieved.

When using the recommended drills to prevent shoulder problems, it is advisable to use all the drills to develop proper technique. When attempting to relieve existing shoulder pain, more of a prescriptive approach may be used. In the former approach, the coach should incorporate stroke development drills into every training session. In the latter, it is important to diagnose the technique related causes of the pain and prescribe the appropriate drills to remedy the problem. In this case, it is important to remember that there may be more than one cause of the pain, and therefore, a need for more than one intervention. Seldomly, do swimmers with good technique exhibit shoulder pain.

The recommended technique and drills certainly don't interfere with performance. In fact, these recommendations aid in teaching speed and efficiency.

Analyzing the causes of shoulder pain, following sound principles, utilizing effective teaching strategies, realizing what to avoid, what to do, and what drills to use will help to avoid or relieve shoulder pain. Follow these ideas and **Kiss Shoulder Pain Goodbye!**