APPENDIX 1: Text One
THE UNKNOWN SHOULDER

THE SHOULDER IS A COMPLICATED JOINT. HERE’S WHAT YOU NEED TO KNOW TO KEEP IT READY FOR THE TENNIS COURT. BY DANA SULLIVAN

AN EXTRAORDINARY EXAMPLE engineering, the shoulder. It’s the only joint in the human body that can move virtually any direction: forward, backward, up, down, out to the sides, rotate a full 360 degrees.

But this mobility comes with a price. The shoulder is runner-up in the "body part most likely to be injured in sports" list (losing out only to the knee). Each year approximately 6 million people visit doctors for shoulder sprains, strains, dislocations, and other injuries, according to the American Academy of Orthopedic Surgeons. Many of those injuries are sports related, with the highest percentage from tennis, swimming, baseball, pitching, and weightlifting. Witness the ongoing saga of Patrick Rafter and his rotator cuff, which is continually strained by his extreme kick-serve motion.

"Picture a gold ball resting on a tee and you start to understand the fragility of the joint," says Stephen Rice, M.D., Ph.D., director of the Jersey Shore
orts Medicine Center in Neptune, N.J., and a board-certified sports medicine specialist who has consulted with the USTA. “It’s a very shallow socket. You picture that tee inserted in a wall away with the ball resting against it. That’s how the shoulder joint is constructed, so you can imagine how vulnerable it is,” adds Rice. Unlike the body’s second-most mobile joint, the hip, the shoulder doesn’t have a cavity on its side. Instead, the shoulder—with the round end of one bone pressed into the socket of another—relies on a complex network of muscles, tendons, and ligaments to keep it stable and facilitate its broad range of motion. These soft tissues are the main things keeping your arm in place after a really powerful serve,” notes Rice. The momentum generated from a serve isn’t what these tissues were designed to handle.

To understand what makes the shoulder so mobile yet so vulnerable, you also have to understand its construction. For all its elegance, the shoulder is actually a complex structure made up of three bones—the scapula (shoulder blade), humerus (upper arm), and clavicle (collarbone)—four muscles—the supraspinatus, infraspinatus, teres minor, and subscapularis—and the tendons that keep those four muscles attached to the bones, a network known as the rotator cuff.

Most shoulder injuries involve the rotator cuff soft tissues—the tendons, ligaments, and muscles—rather than the bone. “The injuries are really an issue of balance,” says Debo-Saint-Phard, M.D., assistant attending physiatrist at the Women’s Sports Medicine Center at the Hospital for Special Surgery in New York.

Most competitive tennis players tend

**REPETITIVE OVERHEAD MOTION LIKE SERVING CAN LEAD TO A REPEATED PINCHING OF THE ROTATOR CUFF TENDONS, POSSIBLY CAUSING TENDINITIS OR BURSITIS.**

They have greater external rotation [they raise the arm out to the side and turn the elbow up and out] than internal rotation [the ability to hold the arm out and the elbow in and down]. This can create abnormal forces on the shoulder joint,” she adds. “Most people are strong and tight in the front of their shoulders [the pectoralis major muscles] and weaker and looser in the back shoulder [the trapezius, rhomboids, and latissimus dorsi muscles].” This muscular imbalance can contribute to overuse injuries such as “impingement” syndromes, which can lead to tendinitis and bursitis. Impingement syndromes are one of the main causes of shoulder pain in athletes. A repetitive overhead motion like serving can cause a repeated pinching of the rotator cuff tendons (though it can also be caused by trauma or age), possibly causing tendinitis (inflammation in the tendons) and/or bursitis (irritation and swelling in the bursae between the rotator cuff tendons and other ligaments and bones).

When the muscles and connective tissues aren’t well-conditioned and there’s too much “play” in the shoulder, it can feel like your shoulder is sliding in and out of position. “Then there’s the potential for injury to the ligaments, cartilage, and bone,” says Saint-Phard. “Your shoulders should move seamlessly.”

It’s the throwing motion, the one you need to serve and to hit an overhead, that’s particularly damaging to a tennis
player’s shoulder, says Mike Nishihara, C.S.C.S., M.S., director of fitness and sports conditioning at Saddlebrook Resort in Tampa, Fla. “It’s a violent action, and if your rotator cuff muscles aren’t strong and flexible, then they won’t be able to stabilize the arm and effectively slow the movement down,” he says.

Stretching and strengthening your rotator cuff and shoulder muscles will help prevent common shoulder injuries (see exercises illustrated in this story). But if your shoulders do bother you, try a couple of lessons that focus on getting your serve and overhead working as efficiently as possible.

“A simple tweak in your overhead motion may help,” says Nishihara. He also has his clients loosen up their arms by throwing a baseball or football a couple of times a week. Gently toss the baseball up, like a pop fly, and throw easy passes with a Nerf ball. “It makes you work your shoulder muscles in a slightly different way than you do in tennis,” he says.

Before working out, though, tennis players need to pay attention on the court. “When your percentage of first serves drops or you’re getting tired and sloppy, it’s time to stop,” says Rice. Baseball coaches count the number of pitches a pitcher throws during a game, he notes. They know that when velocity and accuracy go down, it’s time to give the shoulder a rest and put in a reliever. And while you obviously can’t call in a replacement to finish your match, your shoulder will appreciate you calling it a day.

Dana Sullivan also writes frequently for “Sports Illustrated for Women.”

**VITAL SIGNS** Unless you want to start serving underhand, your shoulder is going to be at risk when you play tennis. Some clear signals that you should see a physician immediately: (1) Your shoulder is stiff and you can’t rotate your arm normally; (2) your shoulder feels like it could “pop” or “slide” out of its socket; (3) you lack the strength in your shoulder to carry out normal activities. Below are other symptoms that may indicate a shoulder injury:

**SYMPTOM**

- Pain and weakness, especially when the arm is extended and raised and lowered; swelling and tenderness.
- Gradual onset of pain in front and upper shoulder; pain when raising and lowering arm; loss of motion; swelling and tenderness.
- The feeling that your arm has “slipped” out of its socket; your arm hangs limply at your side; extreme, sudden pain, and muscle spasms.
- The inability to raise your arm to the side.

<table>
<thead>
<tr>
<th>COULD BE</th>
<th>TREATMENT</th>
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<tbody>
<tr>
<td>Tendinitis</td>
<td>Ice, three times a day for 20 to 30 minutes at a time; for pain, take acetaminophen; for inflammation, try ibuprofen.</td>
</tr>
<tr>
<td>Bursitis</td>
<td>Stop playing tennis, but don’t keep your arm entirely motionless; ice for 20 to 30 minutes at a time, at least three times a day, for pain, take acetaminophen; for pain and swelling, try ibuprofen.</td>
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<tr>
<td>Dislocation</td>
<td>See a physician as soon as possible so that the joint can be realigned. Apply ice for 20 minutes at a time until medical assistance arrives.</td>
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<tr>
<td>Torn rotator cuff</td>
<td>Check with your physician.</td>
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APPENDIX 2: Text Two
Joint account

problems with the knees are among the most commonly suffered injuries for tennis players.

Other Purchase is an osteopath with years of experience. He has treated many tennis players, including John Bird, who treats hundreds of tennis players each year at his practice in Stanmore, north London.

"If you injure your knee you are likely to alter the way you walk, which could then put undue stress on other parts of your body, most notably the hips and back." John explains that, despite the stress tennis puts on our knees, it is nonetheless an extremely stable joint by virtue of its strong binding ligaments and the protective effect of muscles controlling the joint's movements. It also has wide freedom of movement because the bones are not closely bound.
their own configuration.

Knee is one of the three major joints which transmit loading forces to a person's body and the ground. It helps to keep us upright on our feet while standing, walking, running, hopping or jumping.

Knee is known as a hinge joint and is made up of four bones. The two bones in the hinge part of the joint are the femur (thigh bone) and the tibia (leg). The other two bones are the fibula (shin bone) and the patella (kneecap). What makes the knee joint so unique is a meniscus which act as shock absorbers. These are made up of a tough, flexible fibrocartilage and are often known as the knee "cartilages".

All wear and tear of the knee is a frequent complaint among players. John says: "A common injury is known as a 'bucket handle tear' which is a piece of cartilage protrudes from the end, causing acute pain, with the end usually being surgery.

The days most cartilage problems are treated are in the past. Using arthroscopic investigation known as keyhole surgery whereby the cartilage is repaired rather than removed. It's a matter of washing it out, cleaning the area and putting in a brace. It can heal up in weeks. Only if the injury is really bad will the surgeon cut it out."

Most common knee injuries for players are ligament damage or overstretching of ligaments, which attach a bone to another bone. The anterior cruciate ligament at the front and back of the knee, the medial and lateral collateral ligaments are on the inside and outside of the knee. The ligaments' job is to hold the knee together.

Ligament overstress injuries are quick cases. Typically, anti-inflammatory drugs and conservative treatment - which includes ultrasound, deep heat, cold, low-voltage currents and mossage - is used. Manipulation helps the ligaments, especially the anterior cruciate ligament during an indoor game six years ago.

"I went up to save a smash, lost my bearings and hit the back wall, causing my legs to buckle out sideways with a loud cracking and crunching sound," he says. "Everything inside my knee felt like it was moving around. I continued to play for the next 18 months but it gradually got worse and my knee gave up."" Eventually I had keyhole surgery to tidy up the cartilage that was floating around. During the operation, the surgeon informed me that I had severed my cruciate ligament. The choice was to stop playing tennis altogether, undergo further surgery or build the leg up and try using a brace for playing tennis.

"I went for the brace option and had one made to measure by a special manufacturer. Made from indestructible materials including titanium, the brace gives me freedom of movement and agility but locks in either side of the cruciate ligament where it would come under a lot of stress when shifting to move. It took some time to get used to because I had to find a different way of moving. It's black and I look a bit like Robocop in it!"

Tendinitis, which is an inflammatory condition of the tendons, is another common knee problem caused by overuse. The answer is icing, conservative treatment and rest. John Bird says: "The therapist's hardest job is to convince the player to rest. It is very difficult but very necessary. It's better to have a week or two off in the short term than to continue to play and need two or three months off later on."

A build-up of synovial fluid caused by over strain or impact is another common inflammatory condition. To reduce the swelling the answer is RICE: Rest, Ice, Compression (using a bandage or knee support which should be a few inches above and below the knees to stop the swelling appearing elsewhere) and Elevation - raising your leg above your heart.

A particular knee problem junior players should watch out for is Osgood Schlatter's disease, which is very common in girls and boys aged between around 9-14. John explains that this painful condition may occur when the ligaments and tendons are not strong enough to support the growing end of the tibia if overused by exercise.

"Initially the answer is conservative treatment and complete rest to allow the inflammation to subside. Then after it's a case of doing quadriceps exercises to build up the tendons, ligaments and muscles to the knee."

Among the best ways to prevent knee injury is to invest in a good pair of well-cushioned tennis shoes and to keep your knees and legs strong.

"You need to develop good muscle tone of the hamstrings and quadriceps, especially the inner part of the lower quadriceps," says John. "This can be achieved through leg extensions and leg curls. Tennis players should use low weights in high repetitions for prevention and cure of knee injuries."

Cardiovascular work on equipment such as treadmills, bikes and steppers also helps tennis players increase lung power and circulation, which is good for muscle tone. As far as knee supports are concerned, John says these should only be worn if an injury has been incurred and it's being used during rehabilitation. "It should be discarded when the knee is strong enough to take normal conditions to avoid dependency on it and a reduction in the muscle tone," he adds.
APPENDIX 3: Text Three
Getting back

It's estimated that 80 per cent of people will experience back pain lasting more than a day at some time during their life and if you're a tennis player you can almost certainly count yourself in.

The fact that tennis players are so susceptible to back injury is hardly surprising when you consider the dramatic nature of the sport in terms of the speed and mobility that's required. Along with the sudden stopping and starting, the twisting, turning, lunging and bending.

According to Back Care - The National Organisation for Healthy Backs - back pain costs the NHS around £8,000 million a year including physiotherapy, day care, in-patient and GP costs. In addition, sufferers annually fork out a further £350 million on private physiotherapy, osteopathy and chiropractic treatment.

Osteopath John Bird treats hundreds of tennis players at his practice in Stanmore, north London, every year. He reckons that around 40 per cent of the tennis injuries he sees will be back-related.

John says: "Not everyone is that good at moving and can turn easily. A lot of back injuries occur when people are lunging for low balls and are bent over in a low position and turning. This sudden rotation of the spine can cause injury."

He explains that most back cases involve 'segmental restrictions', whereby two adjoining vertebrae become restricted in their range of motion, causing ligament strain and muscular spasm.

"The spine works as a unit; it rotates, it side-bends, it flexes and extends. If for any reason any of the vertebral segments become reduced in their range of motion it will cause ligament over strain, leading to muscular spasm and nerve inflammation."

"One of the biggest problems when this happens is that compensation will take place as the body adjusts to the pain, putting undue stress on other parts of the body. So what might start as one problem can cause secondary symptoms."

The most common form of segmental restriction among tennis players occurs in the lower back also known as the lumbar spine (see illustration, left). One of the secondary symptoms of problems in this area is sciatica; the name given to the pain in the leg that radiates from the lower back and buttock down through the thigh and calf, sometimes reaching the toes.

The answer to the problem is known as 'conservative treatment'. It includes ultrasound, short wave therapy, low-voltage currents and soft tissue therapy (the sophisticated name for massage). Osteopath and chiropractors will also use manipulation to release the affected segments which have been reduced in their range of motion. In layman's terms, this is when they crack your bones and put your back back.

Another secondary symptom that comes from the lumbar spine is known as 'somatic somatic', giving abdominal pain like a bad...
All tennis players will probably experience some sort of back pain during their playing days. How best can you avoid it and what should you do if you get it?

People usually assume that sinister wrong with back pain can often be solved by treatment and medication. Secondary symptoms of the middle back or dorsal column may take the form of chest pain, heart-related trouble. And of the spine or cervical condylar symptoms might be tingling and numbness in arms and hands, as well as nausea and dizziness - all brain-related problems. Full medical investigations, etc., conservative treatment and dilutive therapy can often do little.

Anti-inflammatory, muscle-relaxant tablets are something of a double-edged sword, according to the patient, they can help to control pain and hasten the process. Used on their own, they only mask the problem, creating the symptoms and not solving the root cause. Patients often cause further injury when they try to play hard physical games while taking the pain.

Back problems can be solved with conservative treatment. Some serious cases may even require surgery. One is that of 38-year-old coach Paul Seymour from Hertfordshire, who was doing week coaching and playing in Young County Week 1994, he had a bump and fell to the ground, having suffered a fracture in his lower spine.

Surgery was recommended by surgeons taking bone to fuse three vertebrae in the middle back region. After six months in a corset, underwent ten months of intensive physiotherapy, experienced excruciating sciatica in his right leg and was out of tennis for 18 months. Fortunately he had health insurance! When Paul returned to coaching full time he became meticulous about stretching his back at the beginning and end of each day, and is boastful of the fact that he can now even touch his toes.

The best way to prevent back injury is to invest in a good pair of tennis shoes and stick to a sustained programme of mobility strengthening and stretching exercises, which any qualified gym instructor, physiotherapist, osteopath, manual therapist or GP ought to be able to show you.

"Tennis players, however, are notoriously slack at doing these kinds of exercises, because they find them boring compared to playing the game," says John. "They come to me having been off for a fortnight and ask how they can stop this from happening again. I show them the exercises. They start off very excited, but when they're feeling all right they stop and so invariably they have to come back to me again."

According to John, you've got a twinge in your back and you're determined to keep playing. A heat gel or spray could be helpful to keep your muscles warm before and during the match. Afterwards, an ice pack or spray should be applied to close the blood vessels down and reduce any inflammation or swelling.

As far as back supports are concerned, you should not be wearing one, John stresses. "The only time I would recommend these is if you are recovering from a back-related injury," he says. "They should not be worn all of the time, because of the reduction in muscle tone that would follow."
ASHI took one look at Pilates after her-threatening back injury and used it as an “exercise for wusses”. After just a month of using the bed he had lost two inches around the waist. Five years later, Cash declared thanks largely to Pilates, he was at his best. He now promotes Pilates and videos on the subject.

Many of the world’s leading sportsmen swear by the method, including players of the All Blacks and the New Zealand cricket teams, who as a safe way to develop strength, flexibility and posture. The Pilates method (pronounced pee-lah-tees) is exercise-based system that aims to improve the body’s ‘centre’ in order to lead to a stable core for all types of movement.

Devised by Joseph Pilates, born in Germany, in 1880. Pilates suffered from asthma, rickets and a blood disease as a child and his application and drive to overcome ailments led him to study both in America and Western forms of exercise. He became a competent diver and gymnast as well. He established the Pilates studio in the United States before World War I. Pilates has been in use for over 30 years, not only made a big impact on the exercise scene in the last years, but has also made a significant impact on the way we sit and stand. The exercises have a strong influence on the abdominal muscles, which are called “the girdle of strength”, to help the spine is properly centered.

An all-encompassing mind, body and spirit exercise. A whole approach to fitness that is often shared with techniques such as yoga, T’ai Chi or Alexander technique. The Pilates method tones, stretches and strengthens and is often used to treat injuries. Pilates classes can be studio- or mat-based or a combination of the two. As classes are generally of small numbers - usually around four or five - a high level of personal attention ensures effective training, maximising a student’s potential without risking injury.

A studio class will involve working on specially designed equipment - primarily using resistance against tensioned springs - in order to isolate and develop specific muscle groups. It is gentle but focused exercise with the potential to become aerobic in its advanced form.

At a matwork class, usually for around 12 people, utilises a repertoire of exercises on a mat floor only. This type of class has become very popular in health clubs and gyms across the country, often compared to other forms of body conditioning. Although Pilates is said to be more ‘subtle’ than most body conditioning in classes.

The human body contains more than 460 muscles, but most of them only about 50 of them. Pilates training aims to increase awareness of all muscle groups and to exercise the lesser-used muscles, relieving the strain on those that are overused. Each exercise is stand up to these kinds of movement, not only will you lose a lot of power but you will also be more prone to injury, especially in the lower back and hamstrings.

“Tennis players’ bodies tend to be more one-sided. Right-handed players are stronger in their upper body on the right side and vice versa for left-handers. The effect on the body is that the strong muscles shorten and become even stronger, while the muscles on the opposite side become weaker. Putting strain on the spine, and joints and creating an imbalance in body alignment, resulting in loss of power and possible injury. Pilates can help to redress this imbalance in tennis players.”

“Most of the tennis players I see are riddled with injuries, with strapping everywhere! They keep going because they like playing tennis so much, but they should be doing something like Pilates to condition their body, which will then keep them in the game longer.”

For your first session you will normally expect to see a Pilates teacher on a one-to-one basis. He will assess your physical condition, ask about any problems and about your lifestyle. You will then be shown a series of smooth, flowing exercises and take your joints and muscle through a range of movement appropriate to your needs.

After the first session, you will probably join five or six other people in the studio and the teacher will take time to come around and work with each person individually. You are expected to practise at home and, as your range of movement improves, you can move onto more demanding exercises.

Middlesex tennis coach Peter Butcher. who spends 40-50 hours a week on court, does Pilates in order to remain injury-free. He says: “Pilates has made me feel stronger and more flexible, and has enabled me to keep working.”

Valerie Willoughby, a county veteran
Pilates is an exercise-based system that aims to develop the body's 'centre' in order to create a stable core for all types of movement. Tennis players are turning to it in increasing numbers in order to get rid of pain from nagging injuries.

I started Pilates, tennis made my shoulder very stiff," she said I hardly feel a thing. Pilates definitely enabled me to keep on playing, plus it's made me a lot more mobile around the court. Since I started Pilates I have gone down a size in clothes and I have a flatter stomach and I feel more toned up.”

Corcoran believes the reason why Pilates has really taken off in the last five years is because people have moved away from weightlifting and developing bigger muscles. "These days they want a leaner, more athletic look,” he argues. “People are waking up to the mind-body connection of exercise... the mind and body work together and understanding how they work.”
APPENDIX 5: Text Five
WE'VE GOT SOME GOOD NEWS AND some bad news. First, the bad news:

Simply put, as a tennis player, you're susceptible to back injury. Even on the ATP tour, where superbly conditioned athletes must stay healthy to earn a living, nearly 40 percent of the players have had to sit out at least two weeks with back woes, according to a study by Vijay Vad, M.D., assistant professor of rehabilitative medicine at Cornell Medical Center and medical consultant to the Success Magazine senior tour.

Furthermore, a back problem can set you up for a host of other injuries, from sore knees to sprained ankles. "A back injury may trigger a domino effect," says Stephanie Rehe, a physical therapist in Loma Linda, Calif., and a former Top 10 pro. "It becomes easy to compensate for the injury and put stress on other areas of the body."

Still, don't sign up for a lifetime of chiropractic sessions until you hear the good news: 90 percent of back injuries can be at least partially relieved within six weeks. The keys to making this happen are strengthening the torso to prevent reinjury, improving flexibility, and correcting flaws in on-court technique.

FOR STARTERS Why are tennis players susceptible to back injuries? It's the nature of the sport. The torque required to hit a backhand, extend for a drop shot, or reach for a serve combines to stress the spinal column and its musculature. "Back injuries are common for tennis players because of the rotational demands on the back in nearly every stroke," say Ben Kibler,

CAT/CAMEL STRETCH (increases flexibility throughout spine): Begin on all fours, neck parallel to floor. Arch your back upward like a cat by tightening abdominals and glutes, letting your head drop slightly. Hold for several seconds, then gently let your back sag to the floor, thus forming a slight "U" shape in your back, like the neck of a camel. Hold for a few seconds, then return to "cat" stretch; repeat each seven to 10 times.

CURL UP (strengthens abdominals): Lie on back with both knees bent and feet flat on floor, arms at sides, palms facing in. Press your lower back into the floor and slowly lift head and shoulders. Straighten left leg and hold it parallel a few inches above the floor. Hold for five to seven counts, then lower. Repeat 10 to 20 times.
M.D., medical director of the Lexington Sports Medicine Center in Kentucky and a member of the USTA's Sports Science Committee.

The latest tennis technology doesn't help, either. Longer, lighter rackets can cause trouble by changing swing patterns and increasing the amount of torque on the back.

Playing surface can also be a factor. "Hard courts tend to be tougher on the body," says Bob Russo, M.S., a senior trainer for the USTA, noting that the spine takes the brunt of the shock. "When the ground doesn't give, you put more stress on the lower back with each shot."

Finally, there's your own body to blame. Poor flexibility causes many muscle strains. "Inflexibility in the hip or trunk area is a major factor in back strains," Kibler says.

**WHAT WENT WRONG** If your back is rebelling, the most common culprit is the simple muscle strain—essentially, an inflammation of the erector spinae muscles of the lower back. Such strains can be chronic (an ongoing, dull ache) or acute (a clutch-the-wall stab of pain when you bend over). These micro-tears often trigger muscle spasms as well. To ease the pain, stretch, rest, ice the area in the evening, and apply moist heat in the morning. Take anti-inflammatory as needed. If the pain lasts more than seven to 10 days, see a doctor.

If the back pain continues for several weeks and is accompanied by a mild pain in the back of the leg or butt, you could have a disk injury. "The rotation caused by serving or twisting forward to hit a shot places strain on the disks between the spine," says Vad.

These disks, which act like shock absorbers between the vertebrae, are filled with a gel-like material that can bulge when put through the torsional stress of tennis. This can impinge on the sensitive network of nerves that branch out of the spinal column and cause a condition known as sciatica. (It plagued Tracy Austin for much of her career.) It's named for the sciatic nerve that runs along the back of the leg: "That's why the pain seems to be coming from the leg and butt on one side of the body," Vad says. "But really, it's the pressure of the disk on the nerve that causes the discomfort." If you're still up to playing, the aches may increase when you're serving, and sitting or bending forward will often cause pain. To ease it, try the heat/ice routine for muscle strains outlined previously.

Big servers need to beware of a condition called facet synovitis, which often attacks players who hyperextend the spine when serving (think of the back bends of Pete Sampras and Patrick Rafter). "This move can put an excessive load on the facet joints [the 'little feet' of the vertebrae that connect

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**Keeping Your Back in Business**

Want to keep your back strong and functional? Follow these tips from Stuart McGill, professor of spine biomechanics at the University of Waterloo in Ontario, Canada.

**DON'T** always exhale deeply while exerting yourself during exercise. "That may work for Olympic weight lifters," explains McGill, "but tennis players need to breathe evenly when contracting the muscles." Otherwise, he notes, you can increase the risk of your spine buckling during play.

**DO** focus more on increasing endurance than building muscle during strengthening exercises. For muscle endurance, McGill recommends exercises like the ones in this article.

**DON'T** touch your toes first thing in the morning. "The disks in your back are hydrophilic, which means that when you get up in the morning, they're fully hydrated, like a water balloon," says McGill. "Even bending over to put your socks on puts three times more stress on the disks." Also, avoid bringing your knees in toward your chest when you first wake up.

**DO** contract your ab muscles during daily activities, like waiting at a traffic light or getting out of your car, for the duration of the activity. According to McGill, this helps the spine maintain the highest degree of stability.
One bone to the next," Vad says. This injury tends to cause pain while standing rather than sitting, and when bending backward rather than forward. Again, for help, follow the process for muscle strains described above. If the pain persists, see a doctor.

**WHAT TO DO**

Being a tennis player, of course, doesn't mean you're doomed to suffer from back pain. Stretching and strengthening exercises—and some common sense—can lower your chances of getting injured.

The first step is to make sure you have a stable core. Most tennis players already have strong abdominals, since the motion of hitting the ball works this section of the torso. But don't forget the other muscles of your middle, especially the lower back and obliques.

(To tackle these areas, follow the core-muscle regimen outlined in the September issue of *TENNIS*.)

Just as important as strength, however, is flexibility, particularly in the hamstrings and hips. "The more flexible those are, the less pressure on your back," says Vad. "It's interconnected."

If your hips don't fully rotate when you step in to swing, the spine absorbs more force. The exercises illustrated here will help ease your pain by keeping your core balanced and your lower back and legs flexible.

Since poor on-court mechanics can exacerbate an injury, take a lesson. "A bad swing, a bad serve—over time, these things cause trouble," says Vad.

"Addressing them is key to preventing lower-back problems." And always warm up with light stretches.

Proper care can go a long way. To increase blood flow to the muscles, try a deep-tissue massage or hop in a Jacuzzi. "When it comes to taking care of their bodies, pros don't leave anything to chance," says Russo. "Neither should recreational athletes." 

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**DR. FEEL GOOD**

**Bolle's Teal-Colored CompetiVision Lenses** and CIBA Vision's ProSoft contact lenses are popular with players, but they have a critic in Dr. Michael Marmor, M.D., professor of ophthalmology at Stanford School of Medicine. In the July *Archives of Ophthalmology,* he says the lenses, designed to make the yellow of a tennis ball stand out, don't increase visual acuity. According to Marmor, they make the ball appear greenish (harder to see against the green of a hard court) and darker rather than lighter. He also says the lenses don't block enough blue light to be worn in full sunlight for prolonged periods. Blue is a short-wavelength light, and, according to Marmor, there's evidence that over time it can damage the retina. He recommends gray or amber lenses and a baseball cap.

Dr. Gerald Trees disagrees. Trees, a Vancouver optometrist who's president of the International Academy of Sports Vision and a past Bolle consultant, says these lenses weren't created (and aren't marketed) as sunglasses but as vision enhancers, and that the frames come with other lenses for general sunglass use. "The teal lenses give you 100-percent UV protection and maximize yellow," Trees says. "Blue light does come through, but for a tennis court. It's the best combination of protection and acuity."

Nevertheless, Marmor says there's a danger that users will think they're getting full protection and end up playing tennis in the sun too long.

ProSoft contact lenses feature the same enhancement technology. Dr. Dwight Aksman, global head of professional services at CIBA Vision, says they "make sporty yellow pop," and that "they're to be worn 1 to 2 hours. The package states that people should not wear the lenses full time."
APPENDIX 6: Text Six
MIGHT AS WELL WANT TO ADD SPEED AND POWER TO YOUR GAME? PLYOMETRICS IS A LEAP FORWARD.

BY DANA SULLIVAN

THE BODIES OF TENNIS PLAYERS, gymnasts, track and field stars, and weightlifters differ dramatically from one another. But the top athletes in each of these sports have at least one thing in common: They all use plyometrics. No, this isn't a new dietary supplement or faddish footwear. It's a form of physical training that's sometimes called, more simply and descriptively, jump training. 

Plyometrics first gained attention on the international athletic scene three decades ago when Eastern bloc athletes began experimenting with it. In the 80s, volleyball and football coaches in this country started incorporating plyometrics into their athletes' regimens. And by the late '90s, tennis players like Lindsay Davenport, Todd Martin, Marcelo Rios, and Andre Agassi had all (ahem) jumped on the bandwagon.

SPLIT SQUAT JUMP

WHAT IT DOES: Develops lower-body power and hip flexibility.

HOW TO DO IT: Stand with your feet together, hands on hips, and step forward with your left foot. Your right leg should be bent, with your knee over your ankle (don't extend knee past your toes); the right leg should stretch back, heel off the ground. Now jump as high as you can, switching your legs in midair so you land with your right foot in front. Land softly, in the "split" position. Complete 15 reps.

TIP: This exercise is best done on a forgiving surface, like grass or an exercise mat. To make it more challenging, hold a dumbbell or water bottle in each hand.

PENTAGON DRILL

WHAT IT DOES: Improves foot speed and general coordination.

HOW TO DO IT: Use chalk or masking tape to outline a pentagon on the ground or floor (or you can "draw" an imaginary one). Make each of the five sides 24 inches long. Stand in the center with feet shoulder-width apart. The line directly in front of you is position No. 1. The position just to the right is No. 2, and so on. Keeping both feet together, jump forward to No. 1, then jump backward to the center. Now jump to position No. 2 and back to the center, and so on. Go all the way around the pentagon twice. As you get stronger, try doing this exercise on one leg.

"It's not a form of exercise that recreational players have historically used," says Donald Chu, Ph.D, the acknowledged father of the American plyomet-
JUMP AND REACH

WHAT IT DOES: Helps develop total body power and improves leaping ability.

HOW TO DO IT: Stand with your feet shoulder-width apart. Jump as high as you can while reaching overhead with your arms. Do 10 times, rest one minute, repeat.

TIP: It may help you jump higher if you’re reaching for a goal, such as trying to leap high enough so that you can touch the top of a windscreen.

So what does this mean for tennis players? Muscles that can react quickly, almost automatically, and with maximum power, allow you to accelerate faster and change directions quicker, which are essential skills for any player. And muscles trained for these movements allow you to do so with much less risk of injury. Many of the moves you perform on a tennis court don’t come naturally to your legs. Moving quickly in a lateral direction, for instance, is obvi-
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Not what they do every day. But if you prepare for rapid movements and directions, your body becomes one of how to move that way. "Injuries occur when you get caught off guard and your body doesn't understand what you're asking it to do," says Chu. "Plyometrics teaches you to land correctly on such unusual movements."

Any plyometric exercises also improve core strength. "Core strength, which means the strength in your back, butt, and abdominal muscles, is what you need to connect your top and bottom halves," he says.

Core strength also happens to be the driving force behind every ground stroke and serve, and it can be improved with upper-body plyometric exercises (such as the push-up with hand clap). "Plyometrics are absolutely the best way to train these muscles for the power and speed you need for tennis," says Chu.

If you're feeling like your game could use a bit of a charge, try the exercises.

Dana Sullivan lives in Reno, Nev. She writes frequently for TENNIS and "Sports Illustrated for Women."

A "Blistering" Attack

Don't let the curse of tennis players the world over keep you away from the courts

They can make playing a match pure misery, keep a tennis diehard off the courts altogether, and even force a no default in a tournament. What are we talking about? Bad knees? Shaky serves? Cramps?

None of the above. We're talking blisters, the eternal bane of the tennis player's existence.

In a recent study, it was found that more players at last year's U.S. Open visited the first-aid station complaining of blisters than any other problem or injury, says Rodney Basler, M.D., a Lincoln, Neb., dermatologist and member of the American Academy of Dermatology's Task Force on Sports Medicine. The reason? The stop-and-go nature of the sport.

"Blisters are caused by a combination of heat and friction," explains Dr. Basler, "and tennis players are exposed to both in spades."

When a small part of skin is repeatedly rubbed, friction causes that skin to fill with fluid or blood. Blisters emerge most often on a tennis player's toes, heels, or palms.

But blisters don't have to sideline you. Understand the following prevention techniques, learn how to treat a blister as soon as it starts, and you won't miss so much as a single rally.

1. Invest in at least two pairs of tennis shoes. "Ideally, have two or three pairs of shoes that you rotate," suggests Dr. Basler. Since moisture contributes to the friction that causes blisters, try not to wear the same shoes two days in a row (unless they're completely dry). On those exceptionally warm days, you might even want to change shoes between sets.

2. Keeping your feet well lubricated, particularly when breaking in new shoes, will help reduce friction. Try a layer of petroleum jelly or a thick cream, like Aquaphor.

Prone to blisters? Be sure to keep these supplies in your racquet bag (clockwise from top right): A spare pair of shoes, to put on your feet get sweaty.

Dr. Scholl's Molefoam (for a cushioned layer between sore and sock). A sewing needle, to pierce the blister. Matches, to sterilize the needle.

Blister Band-Aids.

Tincture of benzoin.

DuoDerm, or 2nd Skin.

Coban tape, to keep the Band-Aids in place.

A clean, dry pair (or two) of socks, you can change them between sets.
USH-UP WITH CLAP

WHAT IT DOES: Develops explosive strength in your upper body.

HOW TO DO IT: Perform a push-up and clasp your hands together at the 60% of the move. Start with five repetitions and work up to two sets of 15.

ALTERNATIVE: Holding two dumbbells, stand in front of a 12-inch bench or step. Place one leg on the step, straighten it, and lift yourself up onto the x. Then lift the weights overhead. Alternate legs 10 times each.

opposed by Chu that are illustrated. Remember that in order to be effectivelyometric exercises must be done. When done carelessly or instructed, these exercises can lead to injury. Before beginning this routine, talk with your doctor to make sure it’s right for you (particularly if you’ve had

knee problems). Warm up by jogging or doing another form of aerobic exercise for at least five minutes or until you break a sweat. You should also stretch from head to toe. When you’re finished with the workout, stretch from head to toe once again.

Now go ahead—jump!  

ays wear socks made from acrylics that wick sweat away from the skin. (It is one popular brand.) Because you start playing, apply a layer of antiperspirant to the soles of your feet.

Blister forms on your hands or feet, or the area of a cut-on antiperspirant to the soles of your feet.

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Dr. Feel Good

AT RISK If you suffered knee injuries as a teenager, you're more likely to develop arthritis later in life, according to a recent study conducted by researchers at Johns Hopkins University. The study, which followed more than 1,000 medical-school graduates for almost 40 years, found that those who injured their knees while in their teens had nearly triple the risk of developing osteoarthritis by the age of 65, and a five-fold risk of osteoarthritis if they had knee injuries as adults. Nearly 21 million Americans suffer from osteoarthritis, whose symptoms include joint pain and tenderness. To avoid getting it, your best bet is to limit high-impact activities such as jumping sports and running, which put pressure on your joints, according to Allan C. Gelber, M.D., who led the research team.

LIVING EASY: If you're a guy taking an annual vacation may save your life, according to a recent study conducted by researchers at the State University of New York at Oswego and the University of Pittsburgh. It turns out that men who took annual vacations were less likely to die than their hard-working colleagues who skipped the yearly retreats. To draw these conclusions, the researchers followed more than 12,000 middle-aged men at risk for coronary heart disease and checked them annually during a five-year period. Those men who took vacations during the five-year trial time were about 20 percent less likely to die during the nine-year follow-up period.

—Lambeth Hochwald

skin keeps bacteria out and reduces the risk of infection.

Cover the blister with a Band-Aid. Twelve hours later, pierce and drain the blister again, then do it once more another 12 hours after that. A study done at the University of California at Los Angeles suggested that draining a blister three times within 24 hours is the best way to speed healing time.

If you’re in mid-match, you may need to secure the Band-Aid with a piece of sticky tape called Coban (available at most drugstores). The tape sticks to itself and is thin enough that it won’t interfere with play.

If the skin tears off the blister, protect it with a membrane dressing such as DuoDerm (available behind the counter at most drugstores) and secure it with a strip of Coban.

For large foot blisters, follow the same procedure described above but cover the blister with a small piece of cushiony material, like Dr. Scholl’s Molefoam. Use a dab of tincture of benzoin (can be called Tough Skin) to help keep the cushion in place, then add a layer of Coban tape.—Dana Sullivan

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