Screening for Lower-back Problems

A serious problem for industry, and the most expensive problem in the field of medicine, can be both anticipated and reduced with a high degree of probability . . . by the use of pre-employment or job-placement screening tests for the lower-back.

Which workers are at risk of lumbar problems?

What is an appropriate job for a particular individual?

Of perhaps far greater importance, what is a dangerous type of job for some workers? And why is it dangerous?

Some of those important questions can now be answered with a high degree of probability. At least one of the risk factors in lower-back problems has now been identified.

Stress testing for unsuspected cardiac problems has been a routine medical procedure for twenty years, a required test for airline pilots and a requirement for insurance coverage in many cases.

Now we have a test for a far more common problem, a much more expensive problem. Within five years, screening for lumbar problems will be one of the most frequently performed testing procedures in the field of medicine. The direct and indirect costs of lumbar problems being what they are now, the most frequently published estimate being in excess of forty billion dollars annually in this country alone . . . testing for potential lumbar problems may soon be an insurance requirement for many occupations.

The potential savings to industry, to government and to insurance companies are enormous . . . the return on investment so high that lumbar testing will eventually be a requirement for employment by nearly every large corporation in the country. A routine but very important part of the physical examination for every branch of the military services.

Look at the numbers, all of which are conservative. If there are sixty million people employed in jobs where lumbar problems are common, and there are . . . and if it required twenty years to test them all . . . that means three million tests a year. Then if only three million new workers join the ranks every year, and if only three million people change jobs annually, that is a total of nine million tests a year. Initial tests only; follow-up tests and additional tests required for the evaluation of rehabilitative procedures will easily double that number.

18,000,000 annual lumbar tests is a conservative estimate, the number will probably be far higher; because the savings should run into the billions of dollars, so the tests will be performed . . . must be performed.

The following chart shows the test results that uncovered a previously unsuspected injury in the lumbar-extension muscles . . . an injury that probably would not have been detected by any other type of test.

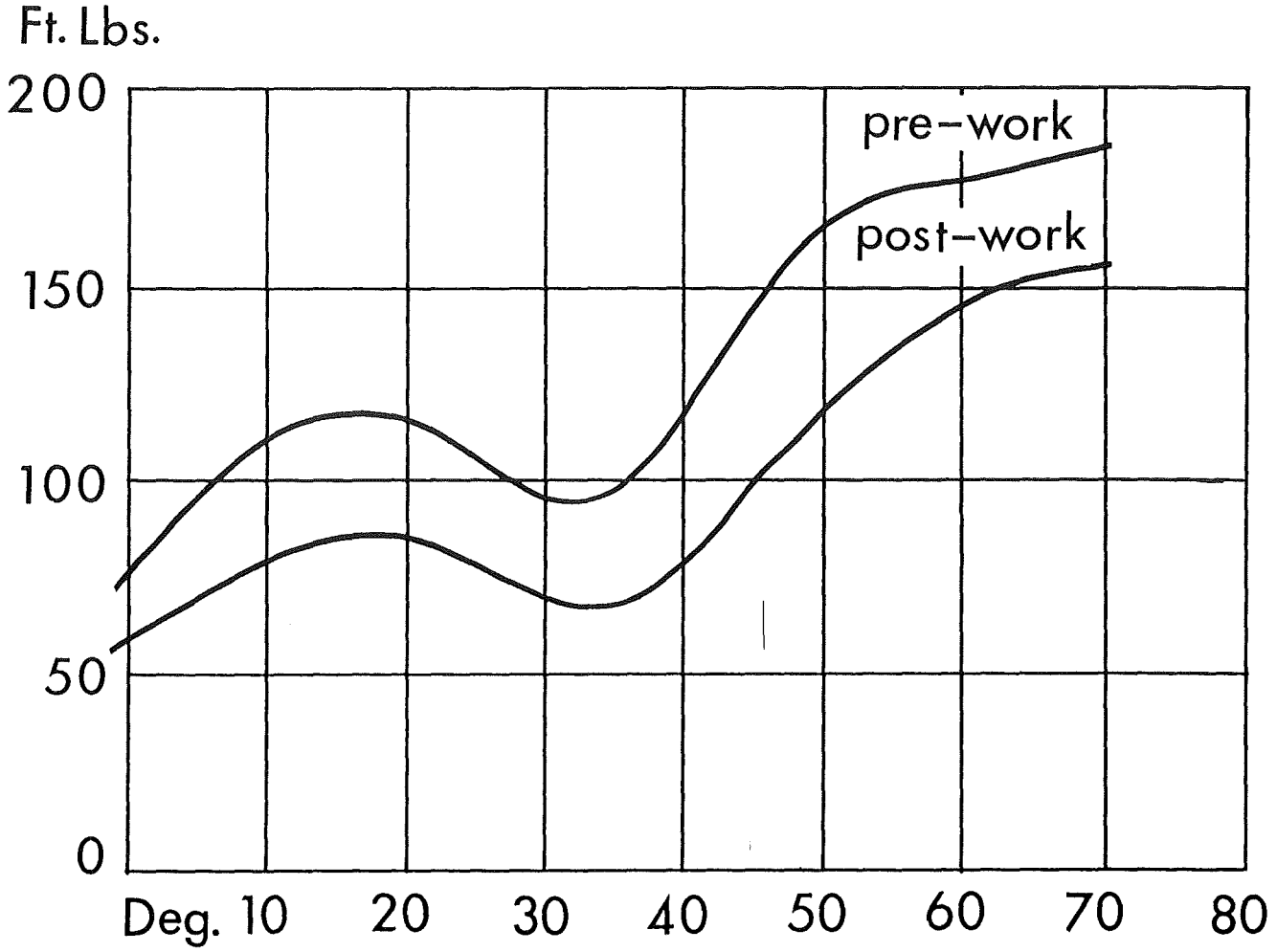

FIGURE 1. **The two curves on this chart are pre-work and post-work test results of the isolated strength of the lumbar-extension muscles. Lumbar strength just before and immediately after a specific exercise. The sudden dips in these curves should not have occurred; clearly indicate both the location and the magnitude of a lumbar injury.**

Compare this chart to the following chart . . . the differences are obvious, cannot be missed. Damage to the soft tissue in the region of the lumbar spine will seldom be revealed by an X-ray, may or may not be detected by a CAT-scan or by Magnetic Resonance Imaging . . . but almost certainly will be discovered by this test. A testing procedure that can be completed in less than ten minutes in a very safe manner, providing instant and very accurate results.

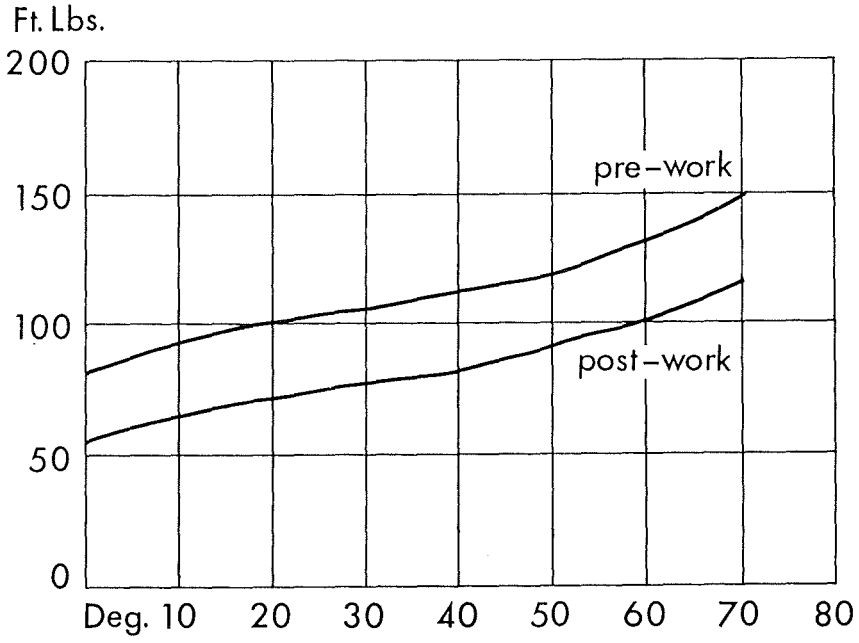

FIGURE 2. **This subject is a middle-aged professor of physiology from Japan, a man with an average level of lumbar strength and a normal lumbar strength curve.**

Some of the information provided by the test results of a normal subject is also obvious . . . tells you several things of great importance when fully understood. Provides a clear warning if an individual is in a high-risk category. Important information for any individual, critical information for many individuals; information that cannot be provided in any other manner. Information that could not be provided in any manner until very recently.

Based upon the results produced by the subjects that we have tested up to date, it appears that approximately thirty

percent of a random group of people are at high risk of injury to the soft tissue in the area of the lumbar spine . . . while about ten percent have a genetic advantage that lowers the risk of injuries in this part of the body . . . about sixty percent do not have a similar advantage, but are well outside the high-risk category.

Totally-specific tests of isolated lumbar function are now being conducted at the University of Florida College of Medicine, under the direct supervision of Dr. Mike Pollock, past president of the American College of Sports Medicine; and in three other locations, with the supervision of equally qualified people, many of whom are board certified Orthopedic Surgeons. By the end of this year we should have completed testing of 30,000 subjects, and will test at least another 100,000 during 1988, so a more reliable estimate of the occurrence of these factors within the general population will be available by the end of the coming year.

These important differences, frequently critical differences, between individuals are produced by genetic factors that are not subject to change. With the use of proper, specific exercise, the lower-back strength can be greatly increased in almost any individual; and increasing the strength in the lumbar muscles will reduce the chances of injury. But subjects in the high-risk group will still be more likely to suffer from lumbar problems. Exercise will help, but cannot alter a genetic risk-factor.

The subject that produced this second chart is neither a high-risk nor a low-risk individual . . . he belongs among the majority group, perhaps sixty percent of a random group of people. The following chart displays the test results of an individual in the high-risk group.

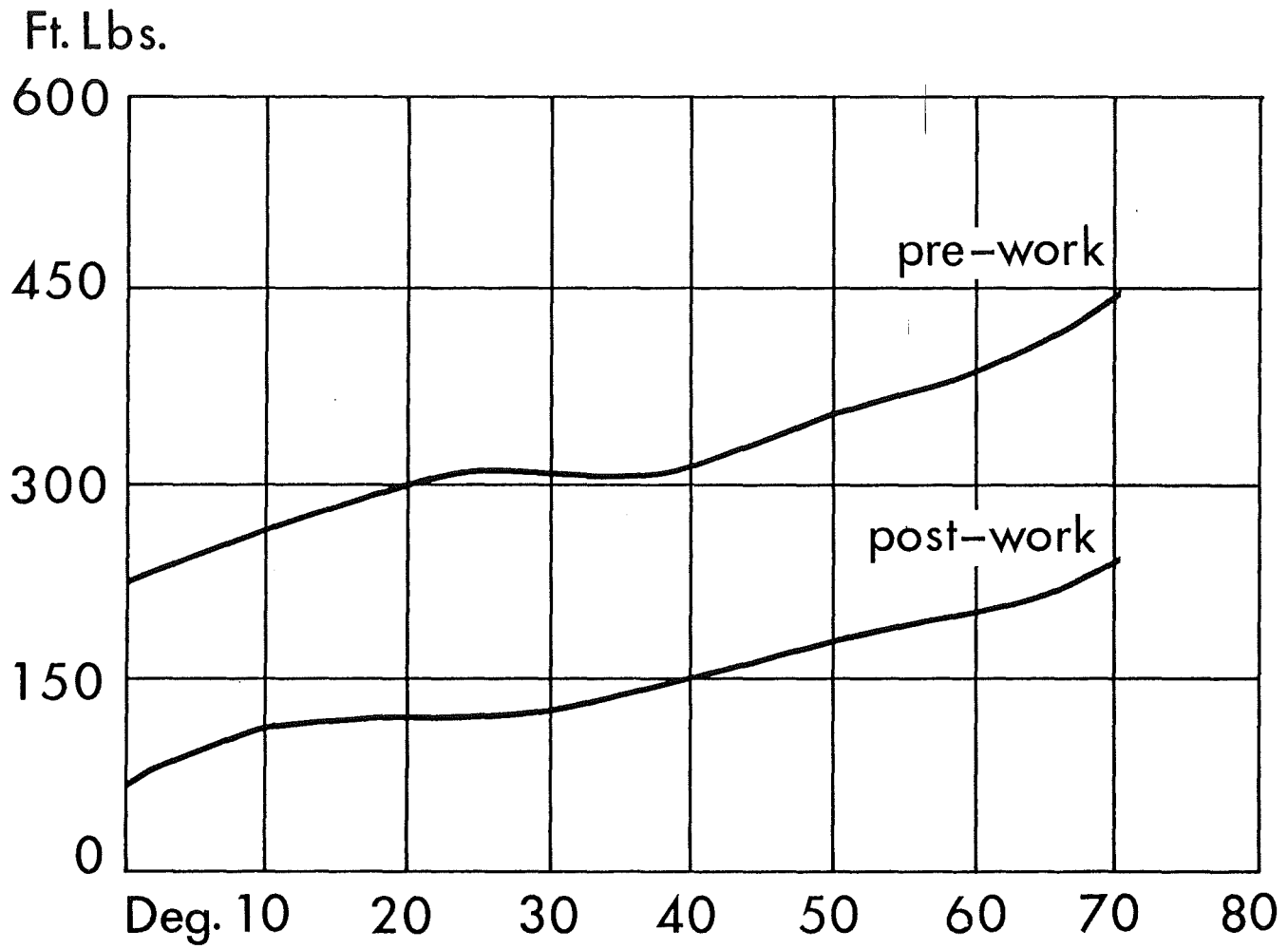

FIGURE 3. Considering his size, average, this is the strongest subject that we have tested up to date; based upon his sex, his age, his size and his previous exercise experience, he is at least twice as strong as an average individual. Which might lead you to believe that he was in a very low-risk group in regard to lumbar problems. In fact, quite the opposite is true; he is the type of subject at great risk.

His high level of strength in the muscles which extend his lower spine is not a result of great muscular size, is a result of the fiber type in these muscles. He has an abnormally high percentage of so-called fast-twitch muscle fibers; a genetic factor which makes him very strong, while increasing the risk of injury.

Given this type of muscle fibers, he has great strength but very little muscular endurance; will fatigue very rapidly even from relatively light lifting, and will be forced by fatigue to change his normal style of working, change to a style of lifting that is dangerous. Employed in a position that involved even relatively light lifting on a continuing basis, this man would probably suffer from lower-back problems.

This chart shows the results of both parts of a test of the totally-isolated muscles that extend the lumbar spine;

the highest curve represents his strength throughout a full range of possible movement, tested with fresh, rested muscles. This being his pre-work level of strength.

The second, much lower curve shows his fatigued level of strength immediately after an exercise for the isolated lumbar muscles. Comparing these two curves makes it obvious that he suffered a very great loss in strength from a rather low level of work.

The exercise that produced this immediate loss in strength was not a maximum effort on the part of this subject, quite the contrary; he performed only six repetitions of the exercise movement with approximately 45 percent of the resistance that he was capable of using with his fresh muscles. Was then incapable of producing additional movement, was forced by fatigue to stop. But even this brief work with low resistance reduced his starting level of strength by 54.9 percent; each of the six repetitions of this light exercise reduced his starting strength by an average of 9.15 percent.

During the exercise he performed a total of only 1,200 foot-pounds of work; which is equivalent to a large man doing only two deep-knee bends with no resistance apart from his own weight, equal to lifting 20 boxes weighing 30 pounds each a vertical distance of only two feet. Lifting them one at a time, not all at once. A very brief stint of light work. Compare this to the results shown by the following chart; a man with a totally different type of fiber in his lumbar muscles, so-called slow-twitch fibers.

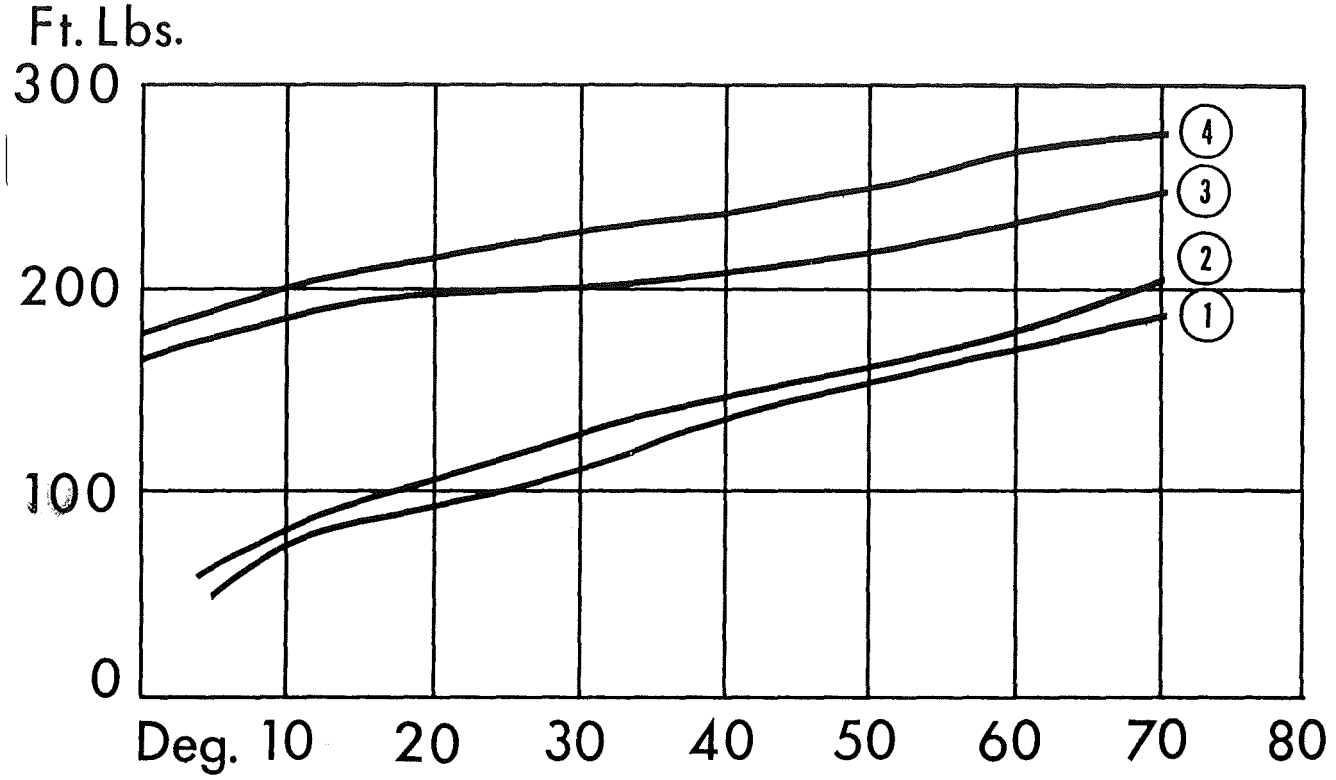

FIGURE 4.

This chart shows test results produced by a very low-risk subject, Dr. Jay Graves of the University of Florida College of Medicine, who has been working on this project for the last two years. His strength is not high in these muscles, because he has the wrong type of muscle fibers for great strength; but he has something of far greater importance, enormous work-capacity, can continue for hours at a level of work that would exhaust the far stronger subject within a matter of minutes.

The lowest of the four curves on this chart, number 1, shows the fresh level of his isolated lumbar strength when we first tested him. Following that test he worked continuously for more than five minutes performing an exercise for his lumbar muscles; then, immediately after the exercise, we tested his remaining strength and discovered that he was stronger after the exercise than he was before the exercise.

The second curve, number 2, shows his strength immediately after the exercise; he was 10.1 percent stronger after the exercise than he was before.

Sixteen weeks and one day later, we tested him again; the third curve on the chart, number 3, shows his fresh strength just before an exercise; while curve number 4 shows his strength immediately after the exercise. This time he was 12.3 percent stronger following the exercise

The lumbar muscles must be tested in total isolation.

than he was before.

During the sixteen weeks between these two testing sessions, Dr. Graves increased his lumbar strength an overall average of 70 percent; while increasing his strength in the fully-extended position by more than 228 percent, with an 8 degree increase in his range of possible movement. Increases in both lumbar strength and flexibility that were produced by a very brief schedule of specific exercise for these critical muscles.

His genetic advantage places Dr. Graves in the very low-risk group, while the previous subject is in the very high-risk group; which man would you assign to a job that involved lifting? During these tests both subjects used the same level of resistance in the exercise portions of the procedure; which was a very low level of resistance for the stronger subject but a maximum level of resistance for Dr. Graves.

A recently-published study attempting to correlate lower-back strength with probability of lower-back injuries found a negative relationship; the stronger subjects suffered more injuries. But they tested for the wrong factor; they should have tested for fiber type. The factor that made the stronger subjects strong also made them high-risk subjects for lower-back injuries.

That study suffered from an additional shortcoming because they did not have a means of testing isolated strength of the lumbar muscles; instead were testing the combined strength of the hips, the thighs and the lower back. A testing procedure that tells you absolutely nothing about the strength of the lumbar muscles.

Weakness in the large muscles of the buttocks and legs is not the problem; on the contrary, the strength of these muscles may be the source of the problem in lower-back injuries. When these larger and far stronger muscles produce a high and dangerous level of force that is then imposed on the much weaker muscles of the lumbar area, then you frequently will have a problem.

To determine the strength of the lumbar muscles, or the work-capacity of these muscles, or the fiber type in these muscles, they must be tested in total isolation; a testing procedure that was impossible until very recently, and is still impossible in any other manner.

But the need for lumbar testing goes far beyond the requirement for pre-employment screening or job-placement purposes. Because of the nature of a high percentage of lumbar problems, other diagnostic procedures can neither confirm nor refute the existence of many claimed injuries . . . which situation has produced fraud on a massive scale; legal problems and insurance costs that can only be estimated, but another annual cost running into the billions.

With a very high degree of probability, the existence of a claimed injury to the lumbar area of the lower back can now be confirmed or refuted by a totally specific test of lumbar function; lacking any other confirmation, an existing injury can be proven . . . or a claimed but nonexistent injury can be refuted. If an injury exists, the test will prove it; if not, the test will prove that too. This has not been established in court, yet . . . but it will be, and soon. The test is utterly specific to the muscles involved in lumbar function, and very accurate. The testing machine is almost a lie detector; if you try to fake the results in an effort to establish a nonexistent injury, the testing machine will catch you.

In order to fake an injury, you would be required to repeat a certain but unknown level of effort in a certain but unknown position . . . unknown to you; but known to the testing machine. It is simply impossible to repeat either the required level of effort or the required position in both parts of the test.

But if you are cooperating . . . then the results will be repeated so closely that all doubt is removed. The test results of a cooperative subject will repeat themselves almost as closely as his fingerprints.

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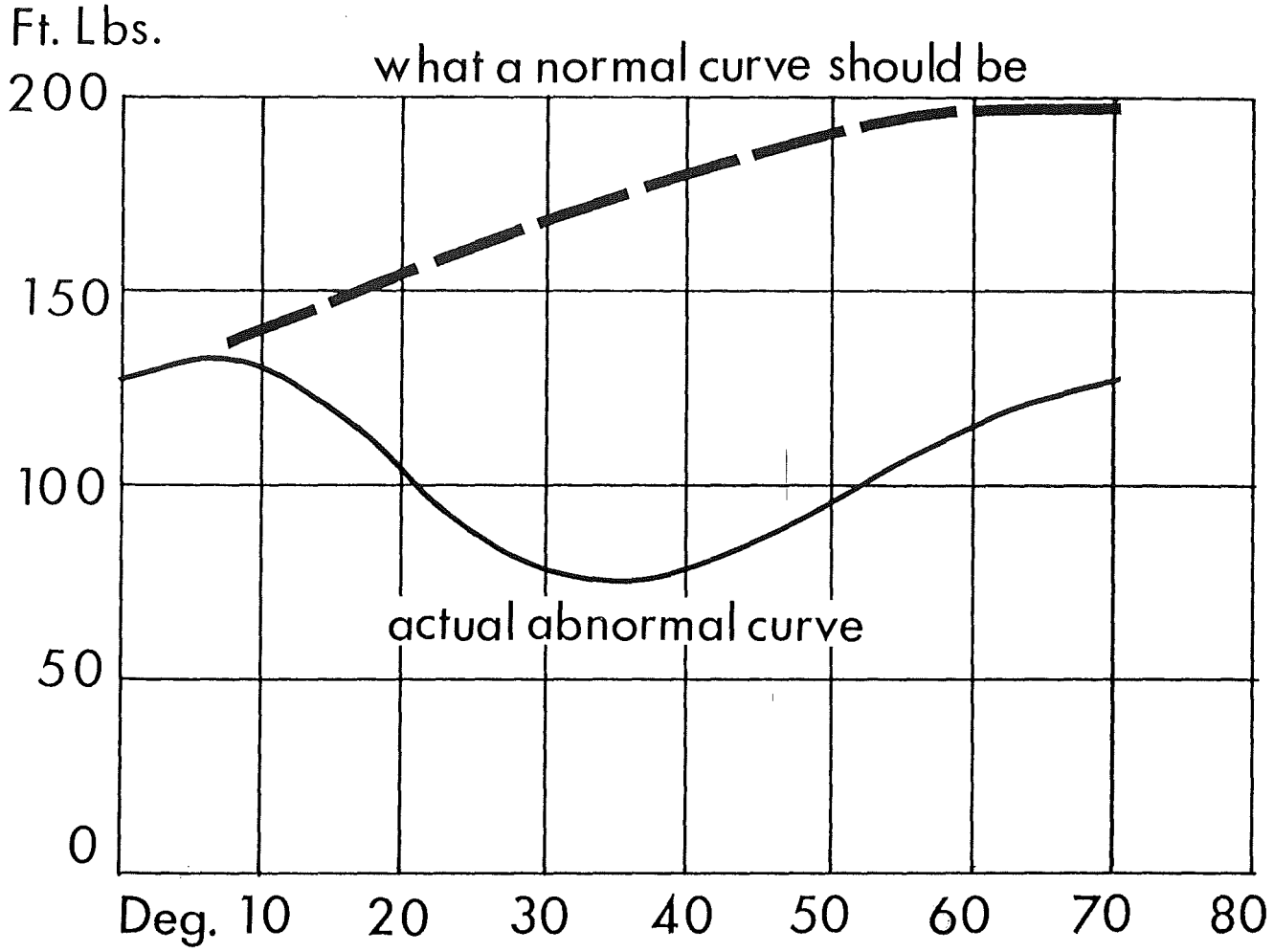

FIGURE 5.

A young female subject with a benign spinal tumor produced the test results shown on this chart. Prior to, and for a while after the test, she denied any history of lumbar problems; but the abnormal shape of her strength curve made it obvious that she had a serious problem so I persisted in questioning her, and eventually she admitted having a tumor.

While very weak in the mid-range of possible movement, her strength in the fully-extended position is far above average for her size; this subject is scheduled for a series of other tests, including a CAT-scan and Magnetic Resonance Imaging, but the results of these other tests are not yet available. When possible, we are doing these follow-up tests on all of the abnormal subjects discovered by the functional-testing procedure, and the results of these other testing procedures will be published in a supplement to this book.

You can reduce the chances of lumbar injury even in the high-risk group.

The dotted line added to this chart shows the shape of a normal lumbar strength curve; comparing that normal curve to the actual test results provides a clear example of the importance of correlating lumbar strength and position, a test of this subject's peak strength would not have disclosed the problem. On the contrary, she would have appeared to be stronger than average.

I do not know what to expect in regard to this subject, so it will be interesting to see to what extent and in which direction her strength curve changes as a result of specific exercise for the lumbar-extension muscles. But the results of specific exercise for the lumbar muscles are usually produced very quickly, at a rate and to a degree that I would not have believed possible as recently as two years ago; so we should have a clear indication of what is possible in her case within a period of only three or four weeks, and a final answer within no more than three months.

Secondary benefits

While you cannot change the fiber-type, you can reduce the chances of lumbar injury even in individuals in the high-risk group; by the use of exercise that is specific to the lumbar muscles, the torso-extension and the torso-rotational muscles.

Even following lumbar injury, these muscles can be rehabilitated in a high percentage of cases by proper, specific exercise. Strengthening the lumbar muscles will then reduce the probability of additional injury.

Dr. Graves, the subject mentioned earlier, suffered a serious injury to his spine approximately ten years ago, and spinal surgery was performed at that time. The injury resulted from an accident while he was playing basketball, and would have occurred regardless of his lumbar strength or fiber type. Following the injury and the surgery, he had a reduced range of movement in his lumbar spine.

When we first tested his lumbar-extension strength and range of movement, his strength in the flexed position was only average, while his strength in the extended position was below average, and his possible range of movement was also below average.

But sixteen weeks later his strength was above average, and his range of movement had returned to normal; during that period his strength in the fully extended position increased at an average rate of more than 14 percent per week, over 2 percent per day. Because of the fiber type in his lumbar-extension muscles, he will never be as strong as some men; but he is now a lot stronger than he was. And this is not an exceptional case; quite the contrary, some of our subjects are doing far better.

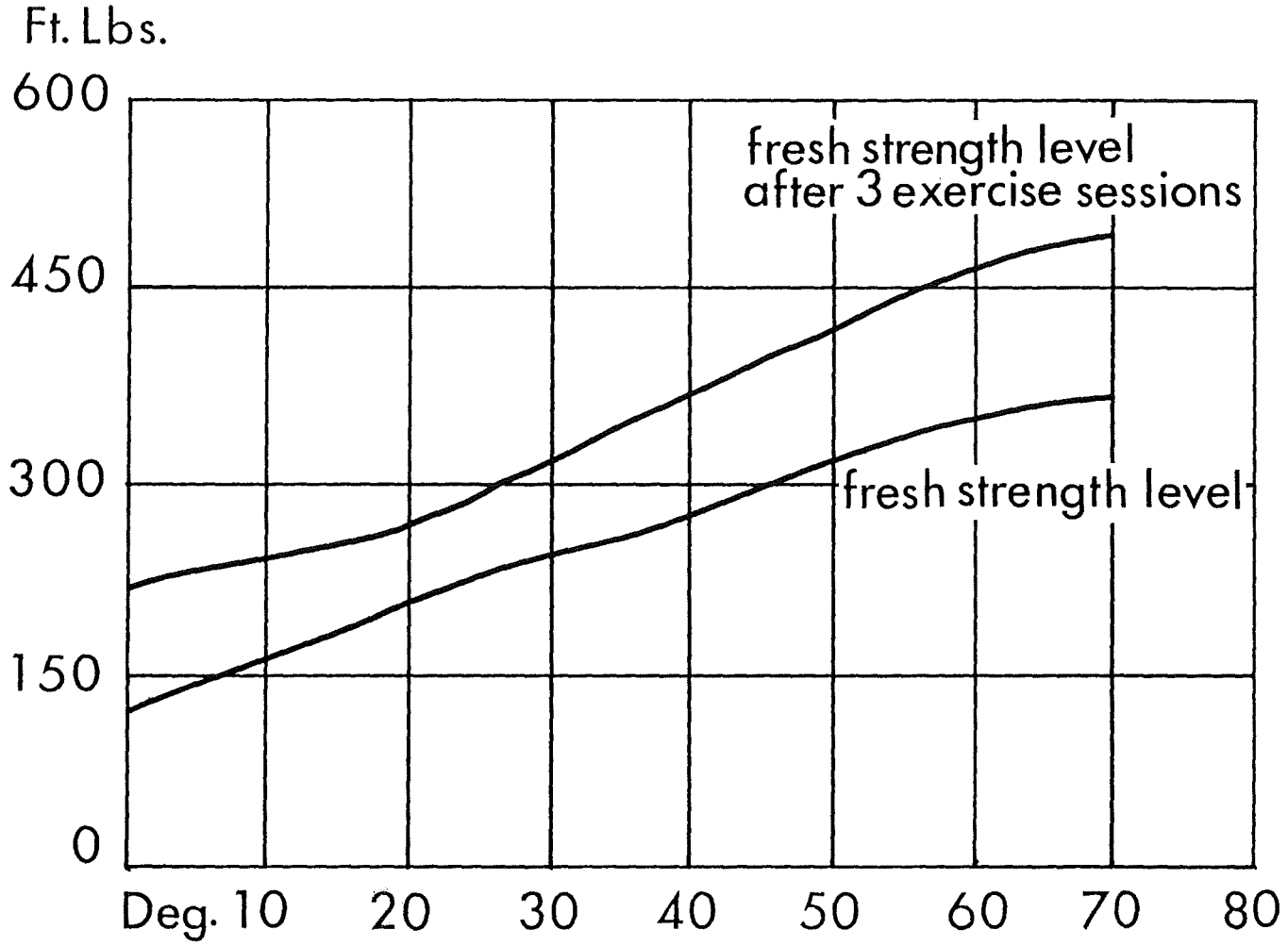

FIGURE 6.

This subject, Scott Leggett, another member of our research staff at the medical school in Gainesville, was already far above average in lumbar strength when we first tested him; a much higher than average level of lumbar strength that resulted from several years of exercise. His range of lumbar movement was normal, and his fiber types in the lumbar muscles were mixed; which placed him

well outside either the high-risk group or the low-risk group.

As part of a carefully controlled research program to determine the results that would be produced by a very limited schedule of exercise for the lumbar muscles, he was exercised only once a week. Using the same machine in which the specific tests of lumbar function are conducted, a combination testing and rehabilitative-exercise machine, he performed only one set of the exercise during each session. Using a level of resistance that would permit him to perform at least ten repetitions, but continuing the exercise until additional movement was momentarily impossible. One set, once a week, with no other exercise for these muscles.

This chart shows the strength increases that he produced as a result of the first three exercises; both curves on the chart are pre-exercise strength tests of his fresh lumbar muscles. The lowest curve was produced during his initial strength test, immediately before the first exercise; the higher curve was produced prior to the fourth exercise. His lumbar-extension strength had increased 36.76 percent as a result of only three exercises, an average increase in excess of 12 percent per exercise.

He was already far stronger than average at the start, strong as a result of his muscular size, not as a result of his fiber type. We will continue him on this program of once-weekly exercise until he stops increasing in strength, and then for an additional six weeks after his strength stops increasing; then we will change his schedule of exercise to twice a week, to see if more exercise will produce additional progress. When these later results are available, they will be published.

Another exceptional case? Quite the contrary; we are finding that almost anybody can increase the strength of these muscles to a degree, and at a rate, that was previously considered to be impossible . . . when they are exposed to totally specific exercise for these muscles. Look at the following chart.

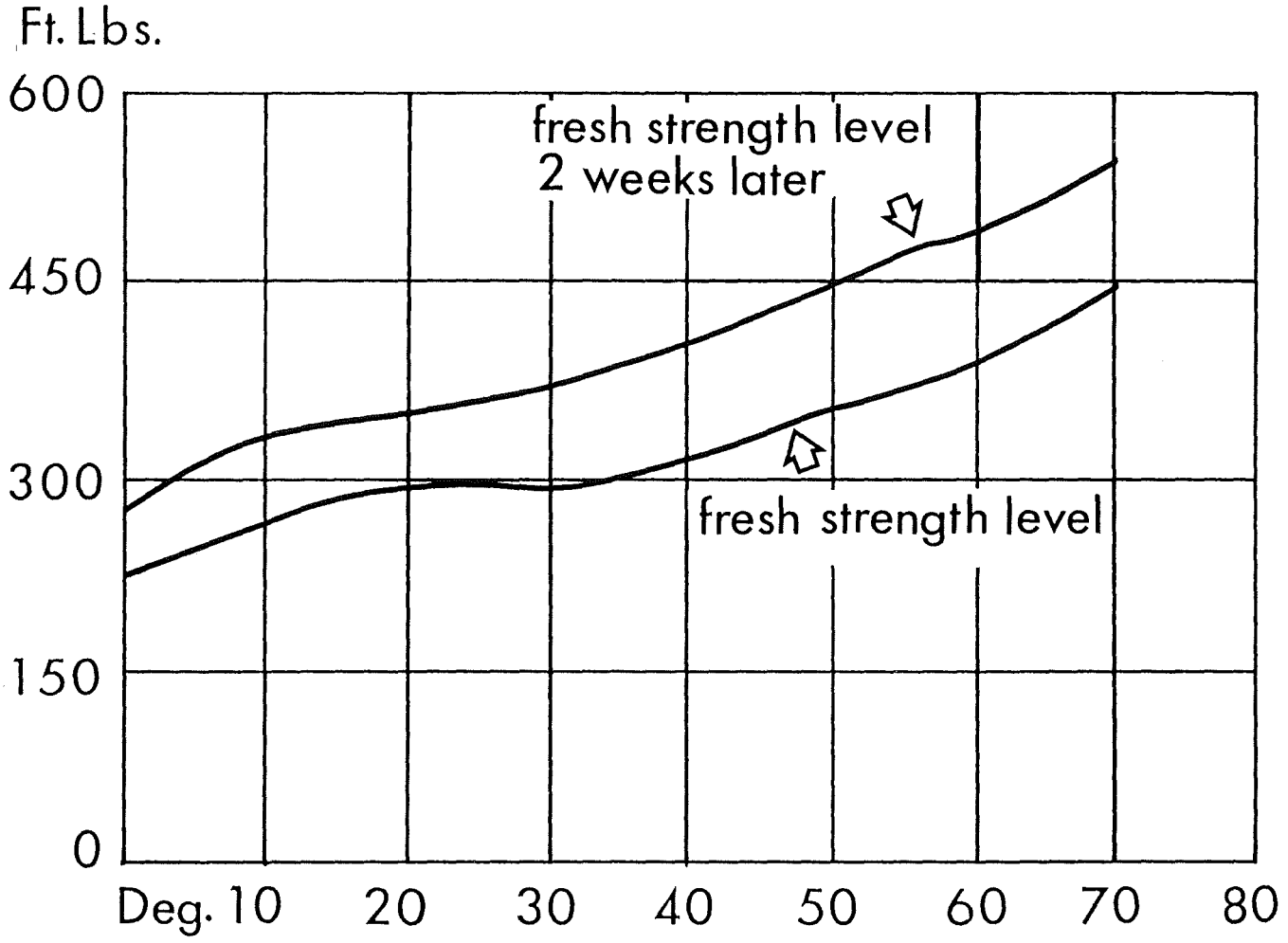

FIGURE 7.

The highest of these two curves shows the fresh strength of the isolated lumbar-extension muscles in another of our research subjects; the lowest curve shows his strength exactly two weeks earlier. During that period of only fourteen days he increased his lumbar strength 23.45 percent, not quite 12 percent per week; and he was far stronger than average at the start, in this case strong as a result of his fiber type in these muscles rather than his muscular size.

Within a period of 18 weeks and 5 days this subject increased his overall strength in lumbar extension in excess of 120 percent; but it should also be noted that his lumbar strength curve changed dramatically during that time. He is a Type S subject in these muscles, meaning that he produces results in a specific manner; will not produce full-range strength increases from a limited-range exercise.

When we first tested him he was more than four and one-half times as strong in the flexed position as he was in the extended position; above average at the start of the movement but below average at the end of the movement. But his strength curve has changed to the degree that he is now less than twice as strong at the start as he is at the end.

He was tested in a total of seven different positions throughout a full range of possible movement; the flexed position being the strongest, and the fully-extended position being the weakest . . . the pattern of strength increases throughout a range of 72 degrees being of particular interest.

Degrees	Percent Strength Increase
72 (Flexed)	73
60	107
48	134
36	110
24	116
12	166
0 (Fully extended)	300

Which clearly demonstrates the importance of correlating strength increases with accurate measurements of position. His average increase was approximately 120 percent, but the increases in different positions varied from a low of 73 percent to a high of 300 percent. Which is typical for Type S subjects when they are exposed to full-range, specific exercise.

Dr. Graves is also a Type S subject, and he produced similar results; in sixteen weeks he increased his lumbar strength by a bit more than 33 percent in the strongest position, but increased 228 percent in his weakest position. Approximately seven times as much in the extended position compared to the flexed position.

Two percent per day in one position, but only two percent per week in another position.

Such dramatic changes in the strength curve will continue only up to a certain point . . . to a point where the strength curve is what it should be; beyond that point, additional increases in strength will be proportionate throughout the full range of possible movement.

Approximately eighty percent of the several thousand subjects that we have tested proved to be Type S subjects, while about eighteen percent are Type G subjects (General). Type G subjects do produce full-range strength increases even from limited-range exercise, and thus have much flatter strength curves at any level of strength.

By the end of this year, 1987, we will publish the results produced by several hundred subjects that are being exercised in this fashion; a wide variety of subjects, men and women, high-risk, low-risk and medium-risk subjects, with an age span from the late teens into the late sixties.

Most of these subjects are exercised only once a week, some twice a week, and some three times a week; by the end of this year we should know just how much exercise is actually required for these muscles, but it is already obvious that very rapid strength increases can be produced by only one exercise a week.

Some subjects may do better with more exercise, but that is generally the exception rather than the rule; which is knowledge of great value to anybody operating a rehabilitation clinic, because a reduced requirement for exercise will produce an increased capacity with no increase in operating expenses. A fifty percent reduction in the amount of annually required exercise will double the capacity of any facility.

We clearly established this fact with the quadriceps muscles nearly two years ago, and are now in the process of doing so with the lumbar muscles, so I will be very surprised if the same general rule does not apply to any voluntary muscle in the body.

For industrial applications, a once-weekly program of lumbar exercises for workers in jobs where lower-back problems are common would probably be a giant first step in the direction of reducing the number of such injuries; such a program, requiring only two exercises performed during each weekly exercise session, would take less than ten minutes a week.

Exercise will not change their fiber type, will not remove some people from the high-risk group, but will increase both their functional and structural strength in these muscles, and will probably reduce their chances of injury.

A large-scale research program in cooperation with a major industrial firm where lower-back problems are very common will be started in the near future and will be continued for several years; but in the meantime it has already been clearly established that stronger muscles do reduce the chances of injury in sports, and there is massive evidence which suggests that the same relationship will hold true in industry.

Now that specific testing of lumbar function is available, together with specific exercise for these muscles, it will not take long to establish just what can be done and what cannot be done to help these critical muscles.