

LDR: Betting on Cervical

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Summary:	Though the company's founders played a crucial role in the development of the first artificial lumbar disc replacements, LDR has itself always taken a somewhat contrarian view toward the promise of lumbar disc replacement. Rather the company is betting on the promise of cervical discs, while rounding out its lumbar line with more traditional fusion approaches.

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LDR: Betting on Cervical

Having helped to pioneer artificial lumbar discs, the founders of spine start-up LDR are cutting against the grain, finding opportunities elsewhere in building a broad-based company.

by David Cassak

More than two decades ago, the principals of LDR Holding helped to launch the revolution in motion preservation by developing one of the first artificial lumbar disc devices. Though founded near the peak of the hype surrounding artificial lumbar discs, LDR itself took an early, contrarian view to lumbar disc replacement, building its company around a line of fusion products and, more importantly, an innovative artificial cervical disc. Given the deep experience of its founders, LDR Medical developed products that quickly began generating revenues. But to fully realize its vision as a global spine player, LDR realized it would need to raise money from the outside and turned to Path4 and its innovative approach to venture investing. The fundraising effort led to the creation of a separate company, LDR Spine, which was intended to both capitalize on the US opportunity and vet Path4's role in the company's development. The merger of LDR Spine and LDR Medical has the company poised to take the next step.

The problem with most technology pioneers is that in those cases in which it becomes clear that the technology won't be the next major breakthrough, they find it almost impossible to give up on their dream. Too much time and energy, emotional and intellectual, has been invested to enable them to turn their backs on their original concept or to recognize and accept its limitations.

Not so for the founders of Austin, TX-based **LDR Holding Corp.** Early on in their careers, while working for a small French spine start-up, the company's three founders, Christophe Lavigne, Herve Dinville, and Patrick Richard, helped develop the first artificial lumbar discs, a technology soon abandoned when the company they were working for was sold to European orthopedics giant Aesculap (now part of **B. Braun Melsungen AG**). But when Lavigne, Dinville, and Richard launched their own company, LDR Medical, a few years later, at a time when the hype around lumbar disc replacement was near its peak, the company took an early, contrarian view, arguing that lumbar disc replacement would amount to no more than 10% to 15% of all spine procedures.

Indeed, in the early years of this decade, few spine executives would have argued against the promise of lumbar disc replacement, particularly if they were interested in raising money from any of the dozens of venture capital firms eager to ride on the bandwagon of artificial discs and motion preservation. The fact that Lavigne, Dinville, and Richard played so important an early role in the development of the lumbar disc only made their contrarian stance that much more intriguing.

But over the past several years, while much of the spine industry has been running in one direction—toward artificial lumbar discs—LDR has been going in a somewhat different direction, building its business around a line of fusion products and, more importantly, an artificial cervical disc, relegating lumbar discs to a secondary priority. Two years ago, LDR Medical took on a group of investors, led by Austin, TX-based Path4, to provide an infusion of both capital and management expertise based on what Path4 officials call their "management-centric" approach to investing. The result was LDR Spine, an Austin-based subsidiary of LDR Medical, designed both to help launch LDR's technology in the US and to test the value of the management-centric investment model.

The merger last year of LDR Medical and LDR Spine into a single company has, say company officials, proven the model and, more importantly, the value of LDR's technology, in particular its innovative cervical disc design. The company's challenge now: finding a foothold in an artificial disc market attracting more

attention from the large spine and orthopedics players.

A New Global Spine Company

Though Troyes, France-based LDR Medical wasn't launched until late 2000, Christophe Lavigne, Herve Dinville, and Patrick Richard had worked together for years, having come together more than a decade earlier while at a small French spine company, JBS. There, the three worked on a variety of projects together including the first artificial disc, the *ProDisc*, which JBS developed in collaboration with Thierry Marnay, MD, a French spine surgeon.

In the early 1990s, JBS was acquired by German orthopedics giant Aesculap, and the artificial disc technology went along as part of the deal. But Aesculap, concentrating more on total joint and trauma than spine, never really saw the potential of the artificial disc, and in the late 1990s, it sold the technology to **Spine Solutions Inc.**, a company founded by orthopedics guru Anthony Viscogliosi, who saw an opportunity to create a company focused exclusively on developing an artificial disc.

In the annals of spine, at least, the rest of the story barely needs telling. Though the artificial disc has a long history in Europe, the technology—and more broadly, the concept of motion preservation—quickly caught the attention of major spine and orthopedics companies beginning a couple of years ago. By the early years of this decade, artificial discs—in both lumbar, where JBS and *ProDisc* started, and cervical, pioneered by Seattle-based Spinal Dynamics and now a major focus of LDR—caught fire. Over a relatively short period of time, many of the first-generation artificial disc players were taken out by larger companies hoping to capitalize on the opportunity, beginning with Spinal Dynamics, which was acquired by **Medtronic Inc.**'s **Medtronic Sofamor Danek** for \$270 million in 2002, and ending with **Stryker Corp.**'s acquisition of SpineCore for around \$350 million in 2004. [W#200210130] [W#200410170] Spine Solutions, itself, based largely on the technology developed by JBS, fetched \$325 million in a sale to **Synthes-Stratec** in 2003. [W#200310022]

Though Aesculap had given up on developing the artificial disc, Lavigne, Dinville, and Richard stayed with the company for seven years after the JBS acquisition. "The idea was that we would design products working with French surgeons, validate those products in the French market, and then get them ready for an international launch," recalls Christophe Lavigne.

Still, it became clear to Lavigne and his partners that spine would always be a secondary priority for Aesculap. "We developed a number of great products, and they're still in use today," says Lavigne. "But we felt we could be doing more and wanted to invest more in R&D, and Aesculap didn't want to." By 2000, the three decided to leave and set up their own company, which became LDR Medical.

A combination of interconnected factors made LDR Medical different from the typical spine start-up. For one thing, as noted, its three founders had worked together, designing products for more than a decade before they launched their own company. That meant that the company began with strong surgeon relationships, something critical to new device development in spine but which many start-ups have to build from scratch. And the fact that those relationships were largely with French surgeons—over the history of spine device development, France has been one of the most fertile grounds for new technology—only accelerated LDR's product development. "We had worked with a lot of surgeons for a long time, and they knew what we could do in designing new products," says Lavigne. "And they kept saying to us, 'If you do something on your own, we'll follow you.'"

But, perhaps for all of these reasons, LDR differed from a typical device start-up in another sense: from the beginning, the company's goal was not to leverage a single technology into a new company—Spine Solutions had, for example, created tremendous value despite, or perhaps because of, its single artificial disc—but to build what Lavigne calls "a new global spine company," with a broad-range of products including pedicle

Having helped to pioneer artificial lumbar discs, the founders of spine start-up LDR are cutting against the grain, finding opportunities elsewhere in b

screws, cages, and other fusion devices as well as motion preservation devices. "We knew it would be more difficult," Lavigne goes on. "But we wanted to be able to offer both fusion and nonfusion technology."

A Cautious Take on Lumbar Discs

In fact, though LDR's founders can lay claim to developing the first artificial disc, LDR's first products—and to date still its workhorse devices, generating revenues in France where they are approved and on the market—are its fusion products, a versatile pedicle screw line and innovative cages.

Despite all of the mania for artificial discs in 2000 when LDR launched—a mania that has cooled somewhat as the first-generation devices have been slower to be adopted than some enthusiasts expected—Lavigne insists that he and his partners never bought into the notion that spine therapy was going to move en masse away from fusion and toward motion preservation. "We worked with a lot of French surgeons, and they never believed that lumbar disc [replacement] would be any more than 10% to 15% of their indications," says Lavigne.

Artificial discs in the lumbar, Lavigne goes on, "work very well" when they're used in the right patients and implanted by excellent surgeons. But if you aren't selecting the right patients, the risk of failure is extremely high, he says: "We always thought [artificial lumbar discs] would be a narrow, narrow indication. It was obvious to us that we couldn't create a company based on 10% to 15% of a surgeon's [case load]."

If anything, LDR officials saw much more promise in cervical discs, and in the two-year period following the company's launch, it was there that they focused their R&D efforts in artificial discs. Just as importantly, despite the prominent role that LDR executives played in starting the trend toward motion preservation, they also spent a lot of time developing their own line of fusion products. "I'm convinced that fusion will continue to grow," says Lavigne.

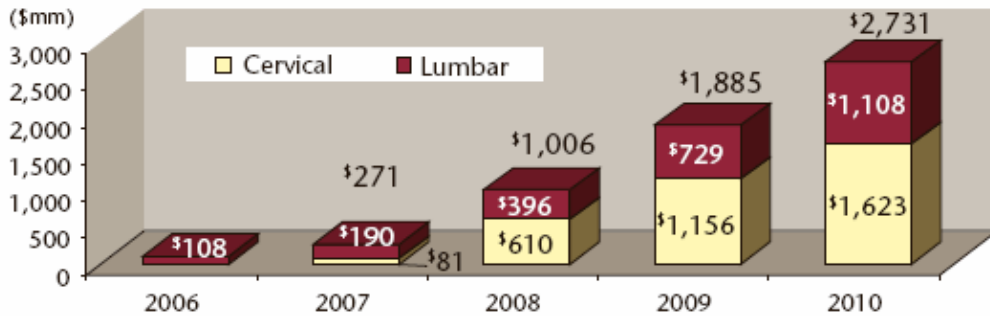
But the fusion cage business was a mature—and crowded—field by 2000, and spine surgeons tend to be loyal to the products with which they've gotten good results. To differentiate its product from others in hopes of winning over surgeons, LDR designed a cervical cage that Lavigne describes as somewhere between long-established cage technology and the growing number of cervical discs that will soon be coming to market. "To get surgeons to switch all of a sudden from fusion to artificial discs in the cervical space would be difficult," Lavigne says LDR reasoned. "So we decided to develop something in between": the first cervical cage anchored with a clip, thus avoiding the need for a cervical plate.

Indeed, says Lavigne, cervical plates work well, but the plate itself makes revisions extremely difficult if follow-on therapy is necessary. LDR's idea: a fusion device that would be self-stabilizing but without using a plate. "We saw this as an intermediary step before [a total disc replacement]," he says.

In the lumbar spine, too, LDR sought to come up with a new, better approach to fusion, again both to provide better therapy and to differentiate itself in a crowded field. As a result, it has developed what it calls the first "open cage" device, using a PLIF (posterior lumbar interbody fusion) approach that gives the surgeon greater leverage against the vertebrae during surgery. "It seems to be a logical approach, but no one had ever developed a device like this before," notes Lavigne.

Exhibit 1

World Wide Artificial Disc Market



SOURCE: LDR

A Mobile Bearing Technology

It's not that LDR isn't betting on motion preservation and artificial discs—just that it sees a well-rounded product line as important. Not all spine procedures will feature disc replacement, particularly in the lumbar spine, company officials argue—and for those that don't, they want to have a line of fusion devices as well. In fact, however, LDR officials are banking a lot on their disc technology and it may, ultimately, be the company's success—or failure—in discs, and in particular, cervical discs, that determines whether LDR succeeds overall.

LDR is currently selling both a lumbar and cervical disc, called the *Mobidisc* and *Mobi-C*, respectively, outside the US. As noted, despite their role in developing what became the *ProDisc* lumbar device, LDR officials never believed that lumbar disc replacement would take a significant share of the procedure volume. But cervical disc replacement is another story: Lavigne argues that penetration of disc replacement in the cervical spine could reach 70%. "Every surgeon I speak with tells me that if they could switch all of their cervical cases to disc replacement, they would," he says.

Indeed, LDR officials expect the market for cervical discs to reach \$1.5 billion in three or four years, though there are no discs currently on the market. Of course, LDR isn't the first company to see gold in cervical discs; by the time the company gets to the US market, perhaps by 2010 depending on the progress of its clinical trial, there will already be several other discs on the market, including a couple from Medtronic Sofamor Danek, whose *Bryan* disc, acquired in the 2003 deal for Spinal Dynamics, was arguably the pioneer in cervical discs and which is expected to be on the market later this year. In addition, lumbar spine specialists Synthes and **Johnson & Johnson's DePuy Inc.** also have cervical discs under development, as do a handful of other companies, including **Cervitech Inc.** and Stryker.

LDR's success will rest, in large measure, not so much on how differentiated its artificial disc is, but on whether surgeons see that differentiated approach as a superior disc. One of LDR's biggest advantages, says Lavigne, is a simpler design that does away with the need for cervical plates, mimics the implant technique used with cages, and allows for faster, less complex procedures—all while addressing multilevel applications. MSD's cervical disc, the *Bryan*, in contrast, he notes, is a one-level disc that requires the use of a stereotactic frame on the patient, which can take 45 minutes to set up, and more than a hundred steps in the surgical procedure. In total, the entire procedure can sometimes last three to four hours.

"A lot of other companies have tried to make a cervical disc by taking a lumbar disc and just miniaturizing it," says Lavigne. "But the load and biomechanical function of the cervical spine are completely different from the lumbar spine. That's why we designed our disc specifically for cervical applications." As for the likelihood

that market leader Medtronic will be first to market with its *Prestige* device, Lavigne says he isn't worried. "They'll open the market for us," he says. "I don't think we could open the market for them, but we'll be in a good position with a better device"—better that is, because it can be used in one- and two-level applications.

Key to the *Mobi-C* device is what LDR officials believe is a fundamentally different approach to cervical disc replacement. "One of the things that we're really betting on is the mobile bearing technology that's behind the *Mobi-C*," says Jerry DeVries, an early investor in the company who has since become its COO. "Essentially, it allows six degrees of freedom, where most of the other competitive discs have three degrees of freedom on average. Some have more, but virtually every other device is more constrained than the *Mobi-C*." And range of motion is really important in cervical discs, much more so than in lumbar: patients actually benefit relatively little from greater freedom to move in the lumbar spine, making stability—and hence fusion—often a more desirable treatment approach. But in the cervical spine, preserving the patient's flexibility and range correlates closely to a better quality of life for the patient and is a key measure of success. Hence LDR's somewhat schizophrenic take on the opportunity in lumbar and cervical spine.

Raising Money

To some degree, LDR officials see their cervical cage device as a kind of intermediary technology for surgeons who, frustrated with plates, still aren't entirely convinced about a cervical disc. Notes Lavigne, "Our cervical cage is really a step before the cervical disc," Still, LDR's strategy in cervical is somewhat the opposite of its strategy in lumbar: because of its belief in the relatively limited potential of artificial discs in lumbar, the company's lumbar fusion devices should be a key part of its product offering for a while. But in the cervical space, LDR executives clearly see disc cannibalizing its cervical cages, if not entirely, at least in large part and certainly within the next 10 years or so.

As noted, it's not that LDR officials didn't believe that motion preservation technology, including discs, is important—in fact, it's a critical part of the company's offering going forward. But LDR's early focus on fusion had another benefit beyond product line differentiation: because the company was able to begin generating revenues quickly—it basically spent its first two years on R&D-related projects before launching its first product—it was able to fund itself without raising venture capital, relying on a small amount of seed capital supplied by the three founders until the fusion products brought in sales.

It soon became clear, however, that LDR would need additional capital as well as some management help. In 2004, it turned to Path4, a boutique investment firm located in Austin, Texas, with deep experience in orthopedics and spine.

Actually, it was Path4 that initially approached LDR about a potential investment. Jerry DeVries, a long-time orthopedics industry veteran, left the former Centerpulse and, with partners Steven Whitlock and Jim Rogan, formed Path4 in 2003, pursuing a nontraditional, more involved venture model that Path4 officials call "management-centric." "The idea was that we wouldn't be traditional investors," notes DeVries. "We wanted to be intimately involved in whatever we did. We wanted to literally and figuratively invest in the company." (see sidebar)

In 2004, Jim Rogan was scanning the Internet when he came across LDR Medical's Web site. The company's product offering looked intriguing, and Rogan hopped on a plane to the 2004 EuroSpine meeting, held that year in Portugal, to look at the technology and to meet LDR Medical's principals. Not surprisingly, though LDR officials always believed in the sustaining role of fusion, it was LDR's innovative disc technology that caught Path4's eye. "The Web site had this wonderful animation sequence, spliced in with an actual surgical procedure, and when you looked at the *Mobidisc* and how it was implanted, it was just brilliant," says DeVries. Rogan's mission: to find a way to convince LDR Medical to partner with Path 4 and its US investors.

Christophe Lavigne notes that there are a couple of keys to success in artificial discs—and a couple of reasons why the technology has, to date, been a disappointment. Obviously, you have to have a good product with good instrumentation, and you have to train surgeons well on the device. But Lavigne argues that part of the problem with artificial discs has been hype: unrealistic expectations about the real potential of the product line.

Five years ago, no spine start-up with an interest in artificial discs would have downplayed the opportunity. Every industry analyst was predicting that discs would be the next major device category—that, in fact, they would usher in a whole new era in spine therapy, one focused on motion preservation—reaching 50% to 60% penetration levels. More importantly, it was precisely that kind of opportunity that made investors' eyes light up. Expressing even the mildest caution was crazy: not only did it run counter to conventional wisdom at the time, it risked undermining the rationale for investment.

But Jerry DeVries says that, in a funny way, that's what made LDR so intriguing. "When we met with them, they said, 'Look, forget what the analysts are saying. Lumbar disc replacement is going to be maybe 10% of the market,'" he recalls. "And the amazing thing is, everything they said has come to fruition."

Is This the Right Model?

For his part, Christophe Lavigne says he was receptive to Path4's solicitation but guarded. Rogan's willingness to jump on a plane was the kind of aggressive, impulsive act that appeals to Americans but makes French executives step back, he says. "I'm French," he says. "When an American calls you up and says, 'We want to do something big with you,' your first reaction is, 'OK, but not so fast. We're open for discussion, but let's be cautious.'"

Plus, EuroSpine may not have been the best place for a meeting: it was only LDR Medical's second major clinical congress, and the company was literally swamped, with both surgeons and European distributors eager to get a look at the company's technology. "I had no time to speak with Jim because we were so busy," Lavigne recalls. But the crowds at LDR's booth only further convinced Path4 that it had hit on something.

But perhaps the biggest issue that Path4 faced was that its approach and business model was so different from that of conventional investors. Indeed, Lavigne notes that LDR was exploring a number of different licensing and distribution options in 2004; the opportunity Path4 was suggesting was different, but was it the right thing?

Indeed, Lavigne concedes that "in the beginning, we didn't really understand what they were proposing." A subsequent meeting in New York gave Path4 the opportunity to explain its management-centric model more fully; in the end, LDR Medical decided to work with Path4, but with a testing period to validate its business model.

In fact, far from having reservations about the prominent management role that Path4's principles would take, Lavigne says "that's why we decided to work with them." But there were reservations about precisely how the new arrangement would work and, more importantly, whether Path4's expertise would be able to accomplish more than LDR Medical executives were doing on their own. Indeed, it's not that Path4's executives could claim to have much spine experience themselves. DeVries was a former marketing executive with Centerpulse's total joint business; Whitlock and Rogan were Centerpulse's VP of R&D and sales, respectively. (DeVries had done some strategic planning projects for Centerpulse's SpineTech business, a pioneer in cages.)

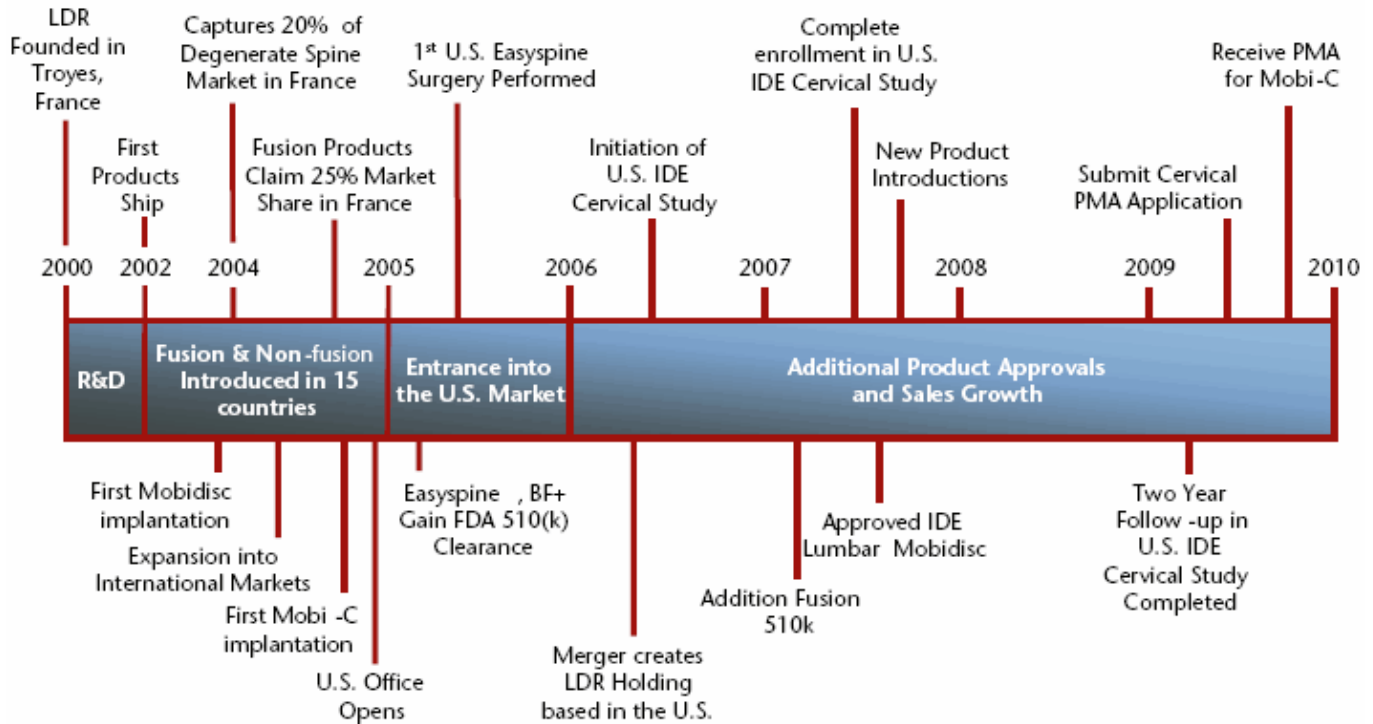
For their part, the Path4 executives didn't see their lack of experience in spine as a problem. "We had some pretty good core skill sets and knew what medical device companies need," says DeVries. And Path4 executives believed their experience in orthopedics would yield some insights into spine. For one, says

DeVries, compared with total joint reconstruction, it was a technology space "with a lot of open IP and a lot of unsolved clinical problems." Although physician and patient satisfaction rates typically score around 98% to 99% in total joints, they're more likely to range between 60% and 70% in spine. "That means there's still a lot of incremental technology development that can have a major impact," says DeVries.

The final deal between the US investing partners and LDR Medical was struck in late 2004, with the former taking a minority stake in the spine company. (In the end, LDR raised \$10 million: \$7 million from Austin Ventures, \$2 million from a third venture fund, PTV Sciences, also Austin-based, and \$1 million from Path4.) As part of the deal, LDR Medical created LDR Spine, a separate legal entity from LDR Medical, with the express purpose of setting up US operations for the company, which would gain regulatory clearance and prepare for US product launch, all while vetting the management-centric model for LDR Medical executives.

Exhibit 2

LDR: A Timeline



SOURCE: LDR

A Sales Challenge

Today, LDR's products, both fusion and motion preservation, are sold around the world in 26 countries—in the US, the company is only selling its fusion device right now, having received 510(k) clearance in 2004. That broad geographic reach, says LDR, represents another difference from a typical device start-up, whose product has largely been confined to a small group of surgeons at a small number of selected clinical-study sites especially regarding disc technology. "But that's not the real world," Christophe Lavigne notes. A lot of things can go wrong when the product moves outside of those centers, where the surgeons have all been extensively trained and manufacturer support levels are high. "We saw that with *Charite* in the US," notes Lavigne. The real test of a device's viability is whether surgeons in the general spine community will adopt and can successfully implant the devices on their own, he goes on. "We're selling our product everywhere,"

he says. "We know that it works."

In the US, LDR's commercialization will be run out of its Austin headquarters; in Europe, Asia, and South America, the company will use a combination of direct reps in France and independent distributors in all other countries managed by LDR Medical in France. In fact, leading with its fusion products, LDR's share of the French market is now between 20% and 25%, with most of the rest of the market split between MSD and **Stryker Spine**. And, hoping to build on that success, the company recently signed on German market specialist **Krauth Medical KG** to handle sales in that country. (See "*Krauth Medical: Finding a Way in the New German Market*," IN VIVO, January 2007. [#A2007800015]) In addition, with the help of Krauth's president and CEO Stefan Widensohler, LDR recently launched LDR China to extend the company's reach into the Far East.

In the US, LDR will use a direct sales force for the most part. "We do have a couple of distributors," notes Jerry DeVries "But we believe that to be able to control your selling effort, to make sure the right message is getting out and that you're getting the proper effort, you have to own the sales force." Indeed, DeVries concedes that initially, like a lot of companies, LDR toyed with the idea of having a combination of direct sales and distributors. In the end, however, company officials changed their minds. "It's more expensive and time-consuming, but we ultimately felt we had to build a direct sales force," he adds.

More expensive, more time-consuming, and also, in many ways, more challenging. Because of the close nature of surgeon/distributor relationships in spine and orthopedics generally, and the deep influence distributors have in shaping their customers' product selection decisions, creating an effective distribution network is one of the great vicious cycles in medical devices: small companies have a hard time cracking into the market without a capable network of distributors, but few distributors are willing to take on a line that hasn't already shown some degree of market acceptance.

A Counter Intuitive Move

Add to that the fundamentally conservative bent of most spine surgeons and the challenge is magnified. And having innovative products doesn't really help—if anything, it sometimes works against companies. "There are well over 70 companies actively marketing fusion products of one sort or another in the US," notes DeVries. Surgeons tend not just to follow their distributor's lead in selecting which product to use, he goes on, "What they'll tell you is that they really like the product, they're comfortable with it. Rarely do you hear a surgeon say, 'I want something better.'" Getting surgeons to break through that comfort zone "to look at something that really is better is very challenging," he says.

For that reason, though there are exceptions, most spine and orthopedic start-ups face a second challenge every bit as great as that of technology development: convincing established distributors to take on their line. Clearly, LDR hopes to skirt that challenge by developing its own direct sales force. DeVries acknowledges that it's "somewhat counterintuitive" for LDR to build its own sales team—if distributors exercise such influence, what possible sway can a direct rep from a small manufacturer have? But, he says, building a direct sales effort is really the only way that a small company looking to break into the market can do it, particularly if that company has truly innovative products. Start-ups that try to use a distributor run the risk that after a while, the distributor will give up on the device and promote someone else's, says DeVries: "But if you turn it over to someone whose only job is to sell that product, day after day, at some point, they'll get their message out."

Getting traction on a direct selling effort is hard, DeVries says, "but it can be done." In LDR's case, company officials are counting on a couple of factors to boost the direct sales effort: the fact that the company's products are widely accepted in France and tend to attract large crowds and surgeon interest at clinical meetings. Outside the US, LDR has tended to build its business by leading with its fusion products, hoping to bring in other products behind them; and, in fact, say company officials, the innovative design of the *Mobi-C*

disc has attracted the attention of not just surgeons, but also distributors eager to take on their line—hence the difference in the sales strategy between the direct focus of the US and the largely distribution-oriented approach in much of Europe and South America. "The *Mobi-C* is a clear door opener for us with distributors," says Christophe Lavigne, who notes that LDR recently signed one major distributor in South America that did 24 cases with its cervical disc in its first two weeks. "It's a very easy product for them to sell and it brings immediate revenue." In the US, LDR is less likely to begin selling the fusion and nonfusion products at the same time because their nonfusion products require regulatory approval via IDE studies.

Also, recent consolidation in orthopedics, generally speaking, has led to the rationalization and reduction of several sales forces and has put talented reps with strong relationships on the street. In addition, LDR is counting on the initiation of a major clinical study of its cervical disc to help, if only because it will put the device in the hands of surgeons who will, for the first time, get to use the device.

Testing the Model

The creation of LDR Spine as a separate entity from LDR Medical was in part an organizational issue—the launch of a separate entity to focus on getting LDR regulatory clearance and commercialization in the US. But it was also a test of Path4's management-centric investing model, a hedge in case Path4's principals didn't deliver. Creating a separate spine operation, says Lavigne, gave LDR executives a year or so "to validate that the [Path4] team would do all of the things they said they would," which included gaining 510(k) clearance for LDR's products, building a sales and distribution network, and launching the company's first major clinical trial.

With progress made in the US, and Path4 delivering on its promises, LDR Medical and LDR Spine merged last May, creating a single company with headquarters in Austin. Under a holding company called LDR Holding, the newly combined organization will have both its Austin facility, focusing on its US business, and its LDR Medical offices located in Troyes, where Dinville and Richard continue to play major roles in the company—the former as head of R&D, the latter as manager of LDR's French operation, still the company's largest. LDR Medical will handle all of LDR's sales outside of the US. "R&D is still in France, while global marketing is in the US, because we want to take advantage of the strengths we've built in each country," says Christophe Lavigne, who has moved from France to Austin to run LDR as president and CEO. "But once it was clear that this was going to work and that we should go ahead and raise more money, it was obvious that we needed to merge the two parts of the organization to form one company and create some synergies."

As Lavigne suggests, one major motivation for the merger of LDR Medical and LDR Spine was to clean up the capital structure of the company. As LDR looks ahead toward additional rounds of funding, "the way the organization was structured was so convoluted, we worried that bringing in an outside investor and getting them to understand what we were doing would be problematic." Indeed, though LDR's products are generating revenues now—the company expects to do around \$18 million this year in sales, most from outside the US—Jerry DeVries says he expects that sometime in the next couple of months, LDR will try to raise a Series C financing. "We're in good shape for a while," he says. "But it's probably time now to bring in an outside investor to validate the business, someone who's got a deep bench with experience in the device space."

To some degree, LDR's convoluted structure was a function of the cautious approach both Path4 and LDR took to Path4's investing philosophy; as noted, though Christophe Lavigne welcomed the management contribution of the Path4 executives, he and his partners wanted a testing period before creating a unified organization. Perhaps the biggest challenge faced by LDR's US group: initiating the company's first major clinical trial—the first concurrent one- and two-level study ever done in the cervical spine. Enrollment began last April. The study will include approximately 300 single-level and 300 two-level implants at about 20 sites, comparing the *Mobi-C* disc with conventional cervical plating; to date just under 250 patients have been enrolled at 15 sites.

The key is the disc's two-level application; LDR officials note that MSD has recently begun its own two-level study on *Prestige* "because Medtronic is very smart and they know this is going to be a multilevel market," says Jerry DeVries. Moreover, LDR officials insist that outside the US, where the *Mobi-C* has been on the market for a couple of years, it has begun to attract a following. Around 2,500 patients have received an LDR cervical disc since 2004 in 26 countries, and LDR has been following a small group of French patients, 215 in all, and has found significant motion in 97% of the cases, about twice the success rate, says LDR, that has been demonstrated by some of the other cervical discs companies in their clinical studies. (In comparison, in the lumbar space, LDR has implanted around 1,500 *Mobidiscs* since 2003.)

Rooting for the Competition

Even today, Path4 executives are as enthusiastic about the original mobile bearing technology LDR developed as they were three years ago. "You can't help but get swept up in what's going on here," says Jerry DeVries. "I'd love to take credit for the company's success, but I can't—I just know that when I see a parade, I get in front." And there's more to come from LDR. Even as it launches its cervical clinical trial, LDR continues to invest in R&D projects on next-generation products and product concepts, including what Christophe Lavigne calls "posterior motion preservation," another alternative to fusion.

Still, virtually everyone at LDR recognizes that the company's future rests on how well it capitalizes on the cervical disc opportunity. That's why the cervical clinical trial is so important. "In cervical discs," notes DeVries, "[the trial] really put us on the map." And clearly, LDR hopes that its trial proves the device's superior profile to other cervical discs coming to market. (If there's one drawback to the clinical trial design, it is that, from a marketing perspective, LDR is restricted to 20 to 25 clinical sites, which means that it is limited in its ability to put the device in the hands of spine thought leaders.)

But LDR officials aren't really rooting against the competition. As noted, they believe strongly that it'll be easier for MSD or **Abbott Laboratories Inc.** to open the cervical market for LDR than the other way around. That's why in lumbar devices, the struggles to gain acceptance of *Charite*, in particular, and *ProDisc* have been a concern not just for first-generation disc developers like J&J DePuy and Synthes, but for LDR as well.

In cervical disc replacement, Jerry DeVries notes that if the first-generation devices do poorly, "it will make our challenge harder in some ways." Indeed, he goes on, almost hopefully, "Medtronic is very smart; it won't fumble on the market introduction of *Prestige*," an odd comment from a competitor, particularly one facing a company with the market presence of MSD. Not that LDR isn't aware of what a strong showing by MSD would mean competitively. But if anything, LDR is "praying that MSD does great with *Prestige*" because that "will open the market" for LDR's device later.

Of course, the stakes in a successful launch of a cervical disc—or any new technology—are different for MSD, with its 35% to 40% market share, than they are for LDR. And in a funny way, that may be the biggest advantage that a small company such as LDR has in facing off against giants—even in a conservative market like spine. "If we could get even 5% of a \$1.5 billion market, we would be very happy," says Christophe Lavigne.

Path4's Single Path

Founded in January of 2004, Austin, TX-based Path4 is the brainchild of three former Centerpulse executives, Jerry DeVries, Jim Rogan, and Steve Whitlock, who left the company soon after its acquisition by **Zimmer Holdings Inc.** in late 2003. [W#200310101] The group's original plan had been to do mostly consulting—at Centerpulse, DeVries, Rogan, and Whitlock had held senior positions in marketing, sales, and R&D, respectively—and to raise a small fund on the side to incubate interesting technologies that they came across. But as Path4 officials embarked on the company's fund raising, their focus turned more and more to venture investing. (See "*Striking Gold in Orthopedics*," *START-UP*, January 2005 [A#2005900020].)

Path4 wound up lining up two sources of capital: a partnership with Austin Ventures, one of the country's largest venture funds, with more than \$3.5 billion under management, and a friends and family fund of around \$3 to \$5 million, raised primarily among friends and colleagues in the orthopedics industry. For Austin Ventures, a huge fund, but one with little experience in healthcare, the Path4 relationship represented something of a new direction. "At the time, they were almost exclusively in high tech, but they wanted to take a small portion of that and dedicate it to health care," notes Jerry DeVries.

Under the partnership, once Path4 identifies an investment, Austin Ventures, either on its own or with syndicate investors, puts up 90% of the capital needed; Path4 puts up the rest. For Austin Ventures, part of the attraction lies in the opportunities in today's orthopedics and spine marketplaces. But part, too, lies in the experience of Path4's senior management group, each of whom has nearly 20 years experience in orthopedics.

Indeed, Path4's approach, which company officials call "a management-centric" take on investing, differs from traditional early-stage venture investing. For one thing, as its investment in LDR Medical suggests, Path4's first play was in a more mature company, one where the challenges are more around commercialization than around technology and market development. Though the completion of LDR's clinical trial is a major challenge both for LDR and for Path4, LDR's technology had already been vetted in Europe and the company was generating revenues by the time Path4 made its investment.

Just as importantly, as part of their investment strategy, Path4 officials like to get intimately involved in the day-to-day management of the company, playing a large role in operations. "When we talk about 'management-centric' venture capital, what we mean is that we have skin in the game, and we're in the company working every day, helping to move things along," DeVries explains. And although LDR officials welcomed the expertise that Path4's seasoned team would bring, they acknowledged some caution early on, hence the launch of a separate subsidiary, LDR Spine, whose goal was both to achieve certain milestones as well as to vet the contribution that Path4 would make to LDR Medical's overall success.

The merger of LDR Medical and LDR Spine into a single company suggests the experiment worked. LDR's president and CEO Christophe Lavigne has even moved to Austin, Texas, to oversee the combined operations from its US base. (It retains its French operations as well.) Still, even DeVries notes that in the beginning, LDR officials "weren't completely sold on our business model [and] wanted to see that we could do what we said we would do."

For Path4, LDR has somewhat changed the game. Even with its management-centric model, DeVries and his colleagues originally figured they'd follow a somewhat conventional investing trajectory, placing bets on a number of different spine and orthopedics plays. "We thought we'd have a microfund, investing several million dollars, helping doctors to realize their ideas before they got swept up by the big boys," says DeVries. "We had modest goals, thinking that we'd bring our connections and experience to help others. But [LDR] has gone way beyond our initial scope." Path4 does have one other play and it's an early-stage company: **Spinal Restoration Inc.**, whose products treat leaky disc syndrome in patients with early-stage degenerative disc disease. But LDR officials concede that LDR has become something of an all-consuming passion. "We're spending five to six days a week on this and have invested everything, our personal fortunes and our reputations, in it," says DeVries.