Osteochondromas are benign masses that generally affect the metaphysis of long bones and are the most common bone tumor. The exact cause of these growths is not known, and there is no treatment other than surgical excision if the lesion becomes symptomatic. Spontaneous resolution is an uncommon phenomenon that is not completely understood. A 12-year-old girl presented with a mass behind the left knee diagnosed as an osteochondroma. She was followed with serial radiographs because the lesion was minimally symptomatic. At 2.5 years after presentation, the patient reported feeling a “pop” with knee hyperflexion, and radiographic follow-up confirmed a decrease in the size of the growth. The protrusion continued to decrease in size until it was no longer detectable with radiographs, physical examination, and advanced imaging. Spontaneously resolving osteochondromas have been previously documented, but the literature is limited. There were just over 20 cases reported as of the writing of this article, and only 1 other case includes postresolution magnetic resonance imaging. This report of localized trauma inducing spontaneous resolution provides additional evidence and insight supporting previous theories on spontaneous resolution of osteochondromas, which may assist in counseling patients and their families regarding expected natural history. [Orthopedics. 2016; 39(5):e1001-e1004.]

To the authors’ knowledge, this is the first case report showing the progression, regression, and complete resolution of a pedunculated osteochondroma as a result of trauma with confirmation of resolution with magnetic resonance imaging (MRI). The purpose of this report is to present a new case of osteochondroma resolution that synthesizes the current theories that attempt to explain the phenomenon.

**Case Report**

A 12-year-old, otherwise healthy, premenarchal girl presented to the authors’ pediatric orthopedic clinic with atraumatic posterior mild knee pain. The physical examination found no palpable mass or other abnormalities. Imaging revealed an exophytic lesion with a thin stalk extending off the distal femoral metadiaphysis medially and having continuity of cortex and medullary canal with that of the
distal femur (Figure 1A). Findings were characteristic of a pedunculated osteochondroma. The plan was to monitor the pain and size with observation and annual follow-up.

At the 1-year follow-up, the patient reported being able to feel the lesion behind her knee and thought that it had increased in size. She did not report pain or associated symptoms. Physical examination confirmed a firm, nonmobile mass above the left popliteal fossa. Radiography confirmed interval increase in the size of the lesion growing away from the joint, which is characteristic of a pedunculated osteochondroma (Figure 1B).

At the 3-year follow-up, the patient was 15 years and 8 months old and postmenarchal. She reported an interval incident 6 months prior of hyperflexion with a painless “pop” felt behind the knee. Within 3 months of the incident, she could no longer feel the mass. Physical examination by the primary physician confirmed no palpable mass following the incident. Radiographs revealed significant regression with only the broad base and small remnant of the stalk remaining (Figure 2). An MRI was obtained 1 month later and showed complete resolution of the lesion, including the cartilage cap, in all 3 planes (Figure 3).

**Discussion**

A 12-year-old girl presented with an osteochondroma on the distal, posterior femur that continued to increase in size until the patient experienced a trauma behind the knee. Subsequently, the mass regressed in size until there was no residual evidence of it on radiographs or MRI.

Few cases of spontaneous resolution have been documented, and there are several theories that attempt to explain the
occurrence. Copeland et al\textsuperscript{4} and Paling\textsuperscript{5} postulated similar theories for lesion regression in which growth arrest of the cartilaginous cap of the osteochondroma allows for remodeling or somatic growth to resolve the lesion. Most case reports cite 1 of these 2 theories in explaining regression.\textsuperscript{2,3,6-15} Other theories that attempt to explain spontaneous resolution exist. Resorption of the osteochondroma as a result of an adjacent pseudoaneurysm is 1 theory.\textsuperscript{16} Another is that local changes after an adjacent surgical procedure change the local mechanical/physiologic environment, leading to remodeling and resolution.\textsuperscript{13} In 2011, Passanise et al\textsuperscript{2} performed a literature review and reported only 24 cases of solitary osteochondroma with spontaneous regression. The current authors found a similar number of cases in their review.

There are several complementary theories regarding spontaneous regression of osteochondromas. Paling\textsuperscript{4} theorized that the regression depends on the relationship between the mass and the bone. That is, if the osteochondroma reaches maturity before the patient reaches skeletal maturity, it will be incorporated into the growing bone with continued somatic appositional growth. However, this theory does not completely explain the resolution of lesions in patients near skeletal maturity (as in the current case), as remaining appositional growth is likely not significant enough to incorporate the mass. Copeland et al\textsuperscript{8} suggested a growth arrest of the cartilaginous cap of the osteochondroma may occur with subsequent remodeling and incorporation of the remaining base or stalk. One of their cases was associated with a fracture at the base of the stalk, which they theorized led to cartilaginous cap arrest and increased periosteal remodeling postinjury.

Song\textsuperscript{13} reported a resolution of a proximal radius osteochondroma and radial and ulnar shaft osteochondromas in a patient with multiple hereditary exostosis being treated with an ulnar lengthening via external fixation. He elaborated on the theory by Copeland et al,\textsuperscript{4} citing a remodeling response of the osteochondroma to an alteration in local mechanical stress or strain. Choi et al\textsuperscript{9} reported a case where resorption occurred with an adjacent pseudoaneurysm. They theorized that the pseudoaneurysm caused a mass effect that led to pressure erosion of the osteochondroma. Mahmoodi et al\textsuperscript{3} examined a case of a partially resolved osteochondroma that underwent surgery for removal of the symptomatic remaining stalk. They found no cartilage cap with grossly and microscopically abnormal vascularity associated with the residual mass and theorized that disruption of the blood flow to the cartilage cap or localized hyperemia might have caused the regression.

None of the aforementioned theories are mutually exclusive. It appears that the 2 main factors most likely to contribute to spontaneous resolution involve growth disturbance or disruption of the cartilaginous cap with local bone growth and remodeling. One may cause the other, but they may also occur independently, as in the case of the pseudoaneurysm-directed resolution in which the cartilage cap damage and remodeling were caused by the growing vascular lesion. There may be a predominance of 1 of the 2 mechanisms, but both likely exist in most cases. For example, in younger patients, local bone growth and remodeling may be the prevailing mechanism for spontaneous resolution.\textsuperscript{10} Claikens et al\textsuperscript{7} reported a case and also reviewed 9 previously reported cases and found that regression was more likely in males younger than 12 years.

In the current case, the patient’s knee hyperflexion caused damage or disruption of the cartilage cap, leading to a growth arrest of the osteochondroma. The associated trauma likely led to the remodeling response because the patient was near skeletal maturity and less likely to remodel with somatic, appositional growth alone. The remodeling theory was further supported by the postresolution MRI, which showed no remnant of the cartilage cap. Reston et al\textsuperscript{12} reported a similar case of spontaneous regression near skeletal maturity that reinforces this assertion and confirms the multifactorial nature of these resolving osteochondromas.

**CONCLUSION**

The current authors’ theory for spontaneous resolution of osteochondromas as a result of cartilage cap growth disturbance with local bone growth and remodeling is a derivative of the theories presented previously and reinforces the current recommendations for management of osteochondromas. In patients with isolated asymptomatic lesions, observation and reassurance should be the preferred treatment. Although physicians should emphasize that the natural history of these lesions may tend toward continued growth or progression to symptomatic lesions (the reason for continued observation), families and patients can be counseled that spontaneous regression is possible, especially in males younger than 12 years, and that regression is possible even near or after skeletal maturity.\textsuperscript{6,9,11,14} Further, little is known about the recurrence of spontaneously resolved osteochondromas, and patients and families should be counseled that recurrence is possible as it is in incompletely excised lesions. Symptomatic lesions should be addressed on a case-by-case basis, as the surgical morbidity has to be weighed against the chance for resolution of symptoms or the lesion.

**REFERENCES**

4. Copeland RL, Meehan PL, Morrissy RT. Spontaneous regression of osteochondro-


