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CASE REPORT

Effectiveness of the "new rope coil" composite core Suoh 0.3 guidewire in the management of coronary artery dissections

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Abstract

Coronary artery dissection is a well-known complication of percutaneous coronary interventions. In this setting, coronary artery dissection is caused by mechanical injury of the arterial wall. However, dissection may also occur spontaneously. In both situations, an intimal tear or dissection allows blood entering and separating the layers of the coronary arterial wall. Despite percutaneous approach is still the preferred and the quickest way to restore coronary flow, it remains challenging. One of the main reasons for procedural failure is due to the difficult advancement of a guidewire into the true lumen. In such situation, the ideal wire should have a soft tip, high torque control, and excellent flexibility. Assuming that, the "new rope coil" composite core Suoh 0.3 guidewire, with its unique combination of characteristics, could allow better orientation insight into a dissected coronary artery increasing the chance of procedural success. We collected a case series of nine consecutive patients in which the Suoh 0.3 guidewire was able to gain the true lumen distally to a dissected segment.

KEYWORDS

complications, guidewire selection, percutaneous coronary interventions

1 | INTRODUCTION

Coronary artery dissection is a well-known complication of percutaneous coronary interventions (PCI). In this setting, coronary artery dissection is caused by mechanical injury of the arterial wall during catheter or wire manipulation, passage or deployment of an interventional device, forceful injection of contrast medium, balloon dilatation, or stenting.[1] However, dissection may also occur spontaneously. Spontaneous coronary artery dissection is a nontraumatic and noniatrogenic separation of the coronary arterial wall.[2] In both situations an intimal tear or dissection allows blood entering and separating the layers of the coronary arterial wall. A false lumen is eventually created within the medial layer which is filled with intramural hematoma. The increasing pressure of the false lumen, by an enlarging hematoma, causes external compression of the true coronary lumen resulting in restricted coronary blood flow and eventually leading to coronary insufficiency. The choice of treatment is largely dictated by the clinical presentation and the amount of myocardium at risk. Despite percutaneous approach is still the preferred and the quickest way to restore coronary flow and improve hemodynamics in cases of ongoing ischemia, PCI for the treatment of coronary artery dissection remains challenging.[3] One of the main reasons for procedural failure during PCI for coronary artery dissection is due to the difficult advancement of a guidewire into the true lumen.[4] Intravascular ultrasound (IVUS) imaging might be of value for the management of coronary artery dissections, however this tool has potential risks, including extending the coronary dissection with imaging catheter and/or catheter-induced occlusion of true lumen. For these reasons, routine use of IVUS in this setting is not recommended, except for angiographically nondiagnostic cases.[5] Although the development of new technologies and technique has simplified, shortened, and improved the success rate of PCI and the management of intraprocedural complications, it is of utmost importance to heed the advice of Dotter and Judkins: "guidewire is passed across the atheromatous block without

going through the wall more by application of judgment than of force."[6] Never like this, judicious guidewire selection, is a critical key step for a successful percutaneous management of coronary artery dissections. We report our initial experience with Suoh 0.3 (Asahi Intecc Co, Japan) guidewire in the setting of coronary artery dissections. We collected a case series of nine consecutive patients in which the Suoh 0.3 guidewire was able to gain the true lumen distally to a dissected segment. In two cases, due to the extreme tortuosity of the dissected vessels, a microcatheter (MC) was necessary to get a better guidewire manipulation.

2 | CASE SERIES

2.1 | Case 1

An ostioproximal left anterior descending artery (LAD) dissection occurred after predilation of a tight and calcified lesion in the proximal segment. During the attempts to advance a stent, the operator lost the wire position and the patient became symptomatic for angina with electrocardiographic changes in the anterolateral leads. The angiography showed a long and severe spiral dissection of the vessel, with a severe impairment of the diagonal branch filling (Figure 1a; Supplementary material 1). A Suoh 0.3 wire was gently advanced through the dissected segment, being able to reach quickly the distal true lumen without any complications (Figure 1b; Supplementary material 2). The procedure was then concluded by multiple drug eluting stent (DES) implantation covering the entire dissection with an excellent final result (Figure 1c).

2.2 | Case 2

A long and occlusive spiral dissection of a very tortuous LAD occurred after a proximal predilation, causing an anterior ST-segment elevation MI. During the attempt to advance a stent the operator lost the wire position (Figure 1e; Supplementary material 3). Due to the severe vessel tortuosity, we decided to use both a Suoh 0.3 guidewire and a Finecross (Terumo, Japan) microcatheter to get a more accurate control of the wire progression, improving the directional control (Figure 1d; Supplementary material 4). We advanced the Suoh 0.3 guidewire very carefully, checking the correct position of the wire with gentle contrast

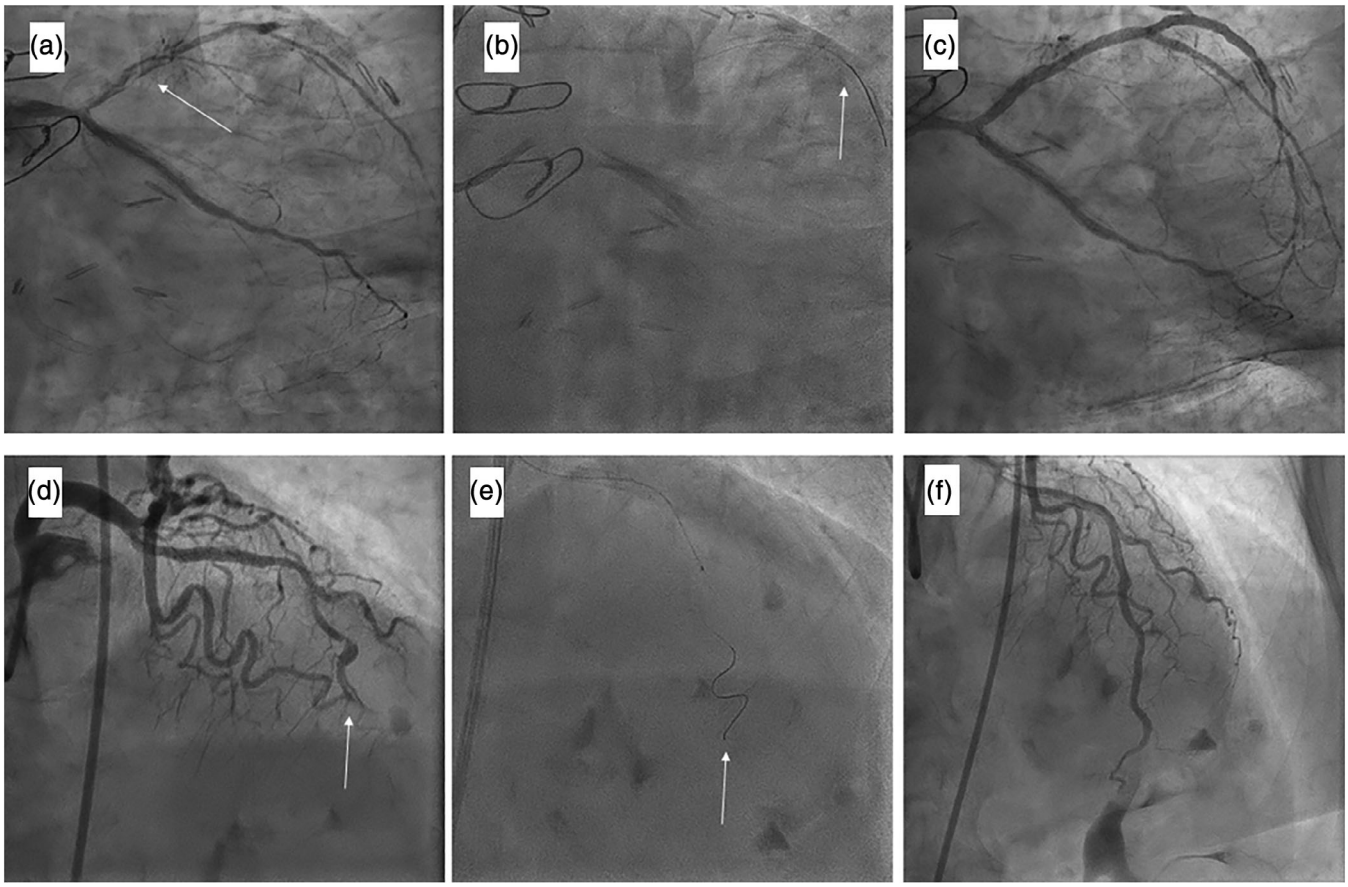

FIGURE 1 (a) The angiography shows a long and severe spiral dissection of the ostioproximal LAD (see white arrow), with a severe impairment of the diagonal branch filling; (b) successful advancement of a Suoh 0.3 guidewire through the dissected segment (see white arrow); (c) final result after multiple drug eluting stent (DES) implantation; (d) the angiography shows a long and occlusive spiral dissection of a very tortuous mid LAD (see white arrow); (e) successful Suoh 0.3 guidewire advancement supported by a Finecross microcatheter (see white arrow); and (f) final result after multiple DES implantation

injections through the tip of the microcatheter, only after having laminar blood back flow into the syringe (that is strongly indicative of intraluminal position). Using the still frame as a landmark, a meticulous and skillful manipulation of the guidewire was performed until the distal true lumen was reached. The procedure was then concluded by multiple DES implantation, covering the entire dissection with an excellent final result and good clinical evolution (Figure 1f).

2.3 | Case 3

A case of focal mid right coronary artery dissection occurred after balloon predilation of a critical stenosis. Due to the tortuosity of the vessel and the lack of support from the guide catheter, the operator lost the position of the entire system during the stent delivery (Figure 2a). An immediate attempt to advance a workhorse guidewire was performed without success, followed by further attempts with several different workhorse guidewires. Due to the impossibility to gain the true lumen, a dual lumen microcatheter was used, resulting in a propagation of the dissection downstream the vessel. Therefore, the procedure was aborted. A few days later, a third successful attempt was performed using a Suoh 0.3 wire that was able to be directed towards the true lumen reaching the distal segment of the vessel (Figure 2b), with an excellent angiographic result after multiple DES implantation (Figure 2c).

2.4 | Case 4

A mid LAD spiral dissection after a PCI of a tight and calcified lesion in the setting of an acute coronary syndrome occurred. After multiple successful predilations, during balloon withdrawal the operator lost the wire position. The angiography showed a long and severe dissection of the mid LAD, with impaired blood flow throughout the course of the vessel. An immediate attempt to advance a workhorse guidewire was unsuccessful because of subintimal tracking (Figure 2d), then we decided to advance a parallel Suoh 0.3 guidewire, that was able to reach the distal true lumen (Figure 2e,f; supplementary file 5).

The remaining five cases are included in Table 1.

3 | DISCUSSION

As previously underlined, one of the main reasons for procedural failure during PCI for coronary artery dissections is represented by the

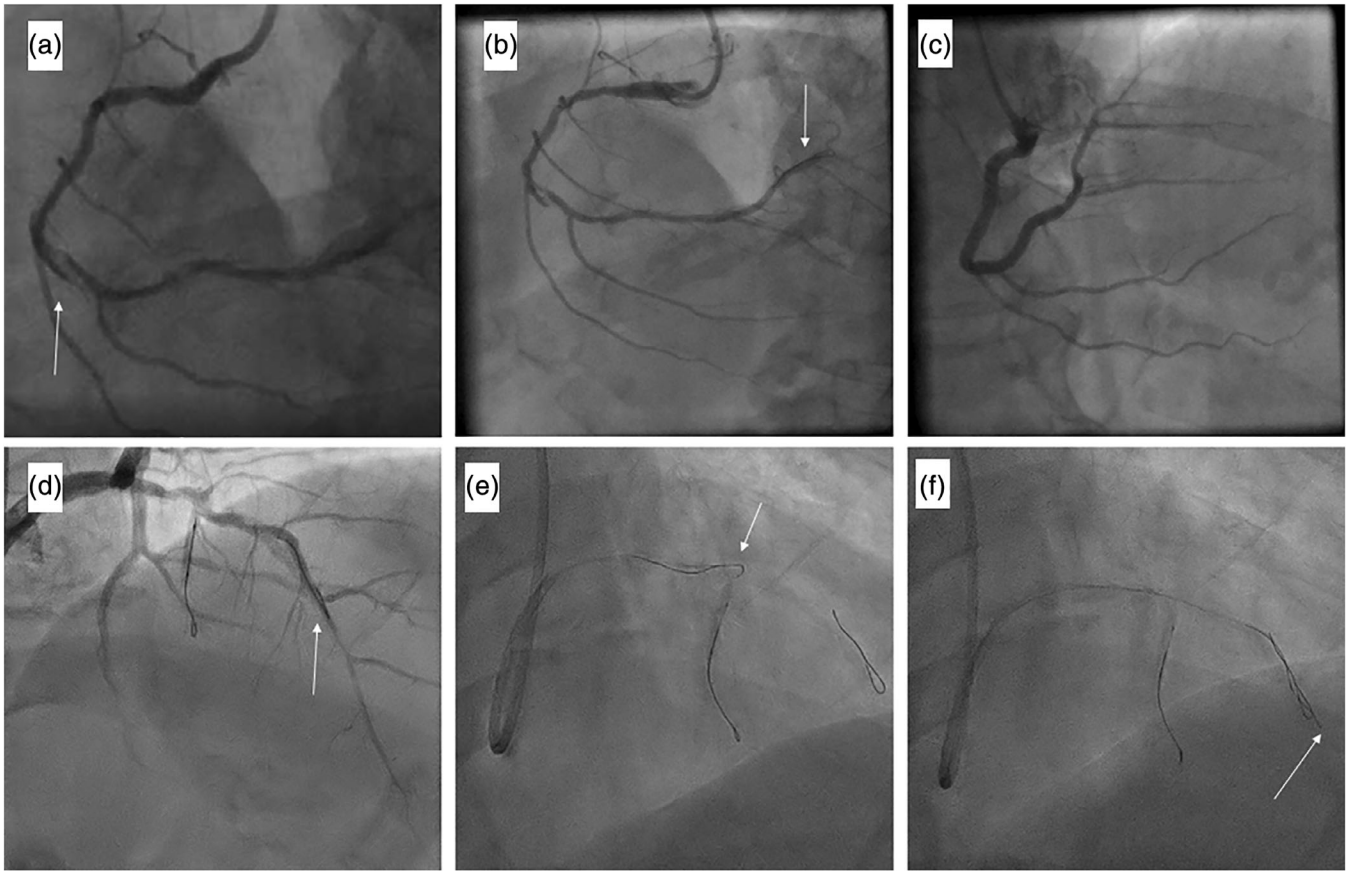

FIGURE 2 (a) A focal mid right coronary artery dissection occurred after balloon predilation of a critical stenosis (see white arrow); (b) successful wire advancement using a Suoh 0.3 guidewire that was easily advanced into the distal true lumen (see white arrow); (c) excellent angiographic result after multiple DES implantation; (d) mid LAD spiral dissection after a PCI of a tight and calcified lesion (see white arrow); (e) Suoh 0.3 "carling effect" (see white arrow); and (f) successful Suoh 0.3 guidewire advancement

TABLE 1 Procedural characteristics of nine consecutive cases of coronary artery dissection successfully managed using a Suoh 0.3 guidewire

	Artery involved	Clinical presentation	Mechanism of the dissection	Successful Suoh 0.3 wiring
Case 1	LADp	Stable angina	Balloon predilation	Yes
Case 2	LADm	Unstable angina	Stent-delivery related	Yes with MC
Case 3	RCAd	Stable angina	Balloon predilation	Yes
Case 4	LADm	Acute coronary syndrome	Balloon predilation	Yes
Case 5	LCXp	Stable angina	Stent-delivery related	Yes
Case 6	RCAp	Stable angina	Catheter-induced coronary artery dissection	Yes
Case 7	LADm CTO	Stable angina	Balloon predilation	Yes
Case 8	OMm CTO	Stable angina	STAR technique	Yes
Case 9	RCAm	Inferior STEMI	Wrong GW advancement	Yes with MC

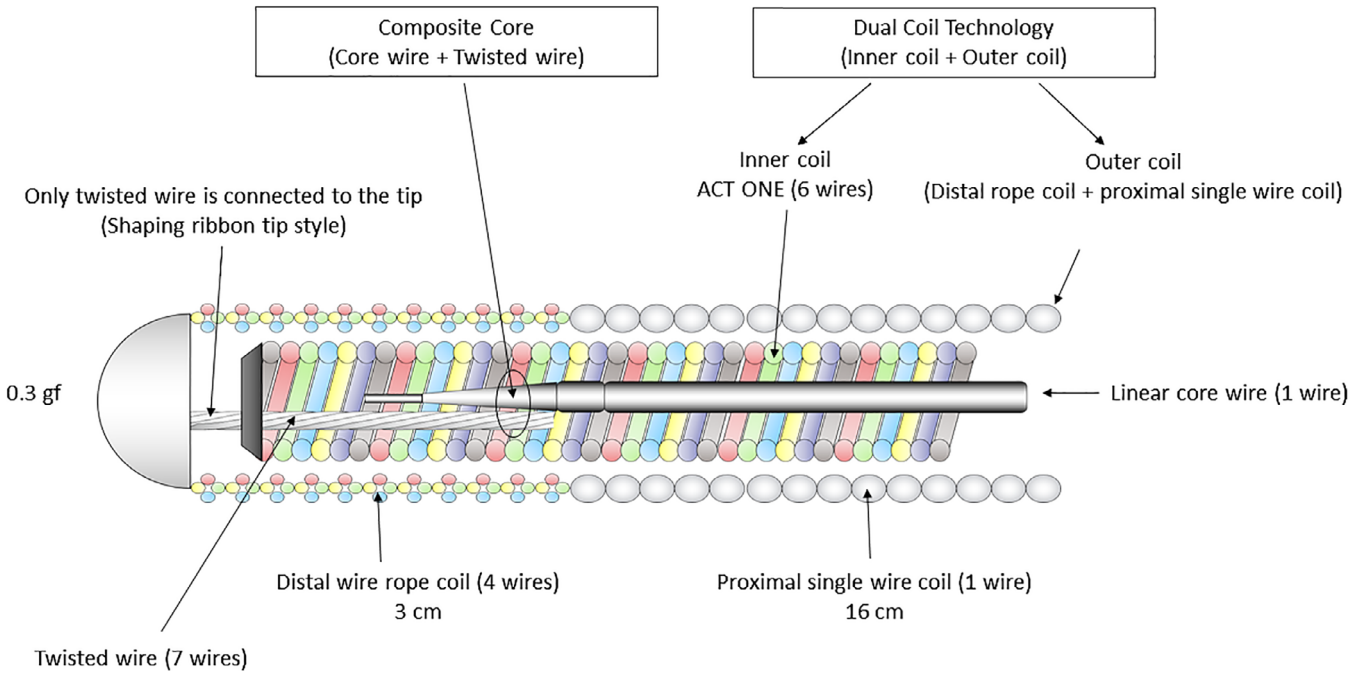

FIGURE 3 Technical characteristics of the Suoh 0.3 guidewire [Color figure can be viewed at wileyonlinelibrary.com]

difficulty to advance a guidewire into the distal true lumen. Indeed, in this setting, the subintimal space represents the area of less resistance to wire advancement compared to diseased segments. A skillful manipulation of the correct guidewire is crucial to gain the true lumen avoiding the progression of the wire in the periadventitial space. In such situation, the ideal wire should have a soft tip, high torque control, excellent flexibility, and good trackability. Assuming that, the recent development of so-called "composite core, dual coil" (Sion Tecc, Asahi Intecc Co, Japan) guidewires can be considered an absolute turning point. The innovative "composite core" technology consists of combining a classic linear core wire (1 wire) with a second twisted wire (7 wires) in parallel, conjoined at the tip. The result is increased and finer torque (1:1) control of the tip. Besides, the "dual coil technology" consists of introducing a second intertwined inner rope coil (6 wires), so called ACT ONE, within the classic outer coil allowing optimal and durable shaping of the tip of the wire, with improved directional control (Figure 3). Among the "composite core" guidewires, we have identified the Suoh 0.3, a 0.014″ flat tip guidewire originally developed for tortuous collateral channel tracking, as the best one to gain the true lumen in the setting of coronary artery dissections. The rationale for such a choice was based on a unique combination of guide-wire characteristics: (a) the distal 3 cm of the outer "rope coil" consists of 4 intertwined wires ("new rope coil") instead of one, resulting in higher flexibility of the tip, while the proximal 16 cm is made of conventional single wire rope coil; (2) only the twisted wire of the composite core is connected to the tip, in a shaping ribbon tip style, providing tip shape retention and softness; (3) the dual twisted coil structure allows high torqueability and steerability, while maintaining good support; (4) the distal 1 mm tip is preshaped to a 45° angle offering excellent shape memory and retention, with the softest tip load (0.3 gf) among contemporary available guidewires. The aforementioned technical features can be useful in

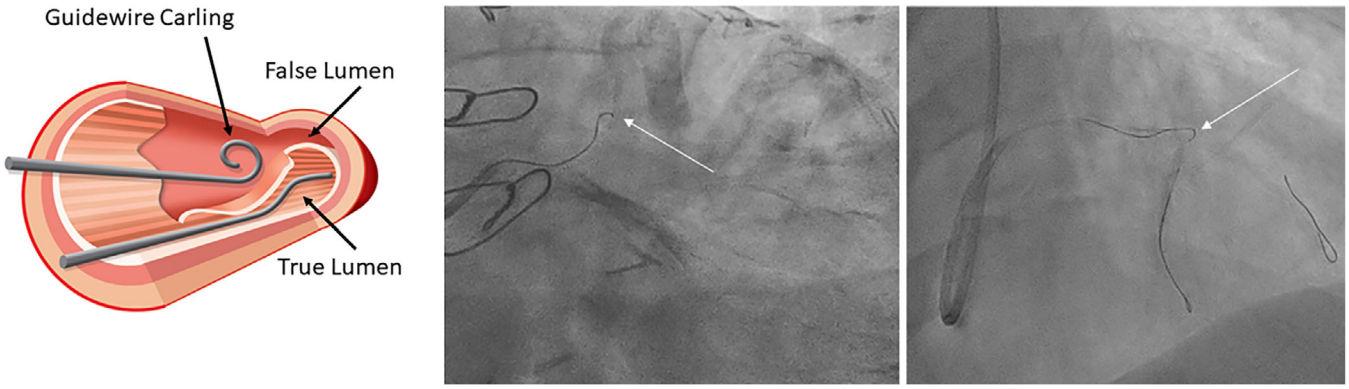

FIGURE 4 Guidewire carling: evident tip deflection in case of wire progression into the subintimal space [Color figure can be viewed at wileyonlinelibrary.com]

the setting of coronary artery dissections, reducing dramatically the rate of wire progression into the subintimal space and, as a consequence, the rate of procedural failure. Compared to the other conventional guidewires, especially regarding the tip softness and the excellent steerability, the Suoh 0.3 guidewire has a higher chance of navigating through the dissected segment following the true lumen, with a lower risk of advancement into the periadventitial space. In case of subintimal tracking using a conventional guidewire, the operator has no any tactile feedback because of the low resistance of the periadventitial space. Conversely, the highly flexible tip of the Suoh 0.3 allows to immediately recognize the progression of the wire into the subintimal space, because of an evident tip deflection, in a sort of "guidewire carling" (Figure 4), while a straight tip progression is strongly indicative of intraluminal tracking (supplementary file 5). Thanks to this visual feedback the operator is able to recognize the intraluminal advancement of the guidewire. In all cases of our series, the intraluminal position of the guidewire was angiographically confirmed without requiring IVUS imaging, which should be performed just in cases where uncertainty regarding the guidewire position is raised.[5] Although our initial experience with the Suoh 0.3 guidewire was very promising, there are three important limitations. First, larger series are needed to establish the overall efficacy of these wires in the setting of coronary artery dissection PCI. Second, due to its unique characteristics the Suoh 0.3 guidewire is very fragile and its manipulation should be more gently than conventional one. Once the tip deflects ("guidewire carling"), the operator should slightly withdraw the wire changing the direction in an attempt to gain the true lumen, looking for a straight tip progression. Third, whether similar results can be replicated in less experienced centers remains to be determined, as visual feedback is extremely important for the correct wire manipulation and requires experience.

4 | CONCLUSIONS

It is of utmost importance to follow developments in the construction of materials dedicated to percutaneous coronary revascularization. The new "composite core, dual coil" Suoh 0.3 guidewire, with its unique combination of characteristics, allows better orientation insight into a dissected coronary artery, due to its highly effective torque transmission and flexibility, increasing the chance of procedural success.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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