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WHAT I HAVE LEARNED

What I've learned

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Eiji Itoi trained at Tohoku University in Sendai, Japan, where he obtained his MD and PhD degrees. He did a shoulder fellowship with Shiro Tabata and then spent 3 years as a research fellow at the Mayo Clinic (1990-1993, 1997-1998). He soon thereafter became professor and chairman of orthopedics at Akita University School of Medicine (2001-2006), and since 2006 he has been professor and chairman at Tokohu University. He has been a Presidential Guest Lecturer at the American Shoulder and Elbow Surgeons and European Society for Surgery of the Shoulder and the Elbow meetings, and most notably, was the Kessel Lecturer at the 2016 International Congress of Shoulder and Elbow Surgery meeting. Dr. Itoi was congress president of the Japanese Orthopaedic Association in 2017 and has been an associate editor of *Journal of Shoulder and Elbow Surgery* since 2011. He has written more than 120 book chapters and published more than 590 articles, most of which have been on the shoulder.—W.J.M.

Prologue

I had my shoulder training and fellowship with Dr. Shiro Tabata, my clinical science mentor, in 1989, when I finished my thesis. I learned many open surgical techniques of rotator cuff repair and open technique of Bankart repair. I also learned arthroscopic Bankart repair using the Morgan technique. During my 1-year fellowship with Dr. Tabata, I also had the opportunity to analyze the patients' data and reported the outcomes.[13-17] Even though we performed the same treatment for patients with the same pathology, the outcomes were different. This caused me to wonder why there was such a difference. This "why" question is extremely important for us to find out the truth hidden behind.

As a resident or a fellow, you learn various things from your mentors. That is an **in-flow** of knowledge and skills. When you start thinking about "why," you will probably be able to find an answer most of the time in the literature. However, if you still cannot find it, you have to find the answer by yourself by doing your own clinical and basic science research. In other words, you can create something new. This is an **out-flow** of your creation into the world. Your knowledge stimulates your creativity and vice versa. I would like to introduce 3 examples of my creation.

My creations

1. Function of the long head of the biceps.

The long head of the biceps (LHB) tendon runs inside the glenohumeral joint, in contact with the humeral head. Its anatomic relationship with the humeral head changes with the change of arm rotation and arm elevation. This anatomic feature is very unique: there is no other such tendon in our body. This is what I have learned from the anatomy textbooks, literature, and anatomic dissection (**in-flow**). My question was "Why does it have such a unique anatomic feature? Because of its anatomic proximity to the humeral head, it should have certain function on the motion and stability of the shoulder" (**why question**).

I wanted to do this research in Japan, but my boss said it was of no use. Then, I was given an opportunity to go to the

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Orthopaedic Biomechanics Laboratory, Mayo Clinic in 1990 as a research fellow. I talked to Dr. An, my basic science mentor, about this research idea, and he immediately said, "Go ahead." I was able to do the research on the stabilizing function of the LHB tendon with one of the second-year residents, Neil E. Motzkin,[11] for which we won the 1992 Neer Award for Basic Science, one of the most prestigious awards in the areas of shoulder and elbow research. I advanced this study in a series of cadaveric studies with other residents, David K. Kuechle and Stephen R. Newman.[8,12] I further extended this research on contribution of the LHB to shoulder motion when I visited Mayo Clinic the second time in 1997.[10] These studies are the **out-flows** of my why question.

2. Conservative treatment of shoulder dislocation.

I was always wondering why the recurrence rate was so high among the young patients after an initial dislocation of the shoulder. The younger the patient, the higher the recurrence (**in-flow**). This was totally opposite to our common sense that the younger the patient, the faster the tissue healing. In addition, I learned the facts that various length of immobilization and various rigidity of immobilization did not make any difference in the recurrence rate (**in-flow**). These facts did not make sense to me because the longer and the more rigid the immobilization, the better the tissue healing should be. My question was "Why the younger the patient, the higher the recurrence?"(**why question**). The only reasonable explanation was that the soft tissue lesions were not in contact with each other so that they did not heal even after a certain length with certain rigidity of immobilization. In other words, the position of immobilization might not have been correct.

Since the era of Hippocrates, the shoulder had been immobilized to the trunk after a dislocation. Is this position correct? To my surprise, there had been no studies to show whether this position was good or bad. This was the very beginning of our serial studies related to immobilization in external rotation[3-6] (**out-flows**). Although there have been pros and cons on the effect of immobilization in external rotation, our most recent meta-analysis shows that immobilization in external rotation significantly reduces the relative risk of recurrence by 36% ($P = .014$; unpublished data). Our recent study has shown that the reduction of the soft tissue lesion with the arm in external rotation is better with the arm in abduction than in adduction.[7] Based on these findings, a multicenter prospective randomized study is under way in which we are going to compare immobilization in internal rotation versus immobilization in abduction and external rotation (**out-flow**). The American Shoulder and Elbow Surgeons awarded our team the 2003 Neer Award for Clinical Science for this work.

3. Bony lesions of unstable shoulder.

I was also very much interested in bone loss of the glenoid in shoulders with anterior instability. All of the textbooks said that a bone loss greater than one third of the glenoid should be treated (**in-flow**). I thought "How do we know that a lesion is one-third of the glenoid?" If the shape of the glenoid is circle or square, we may be able to roughly estimate one third of the total area, but it is not accurate at all. Considering the complex shape of the glenoid, it is almost impossible to say this is one third of the glenoid. My question was "Why would people accept this indication of surgery? How do they define the size one third?"(**why question**). The description "one third" is qualitative, not quantitative. As long as we say one third of the glenoid, we will never be able to clearly define surgical indication of the glenoid bone loss. This was the beginning of my research on glenoid bone loss.

First, the normal average shape of the glenoid was determined. Then, an anteroinferior bone loss was created stepwise, and the stability was measured with and without a Bankart repair.[9] This study showed that a bone loss equal to 21% of the glenoid length or greater caused substantial instability even after the Bankart repair. We later found that the glenoid defects were located anterior, not anteroinferior, to the glenoid.[19] Consequently, we repeated a similar study, but this time with a bone loss created anteriorly. This study clearly showed that a bone loss of 25% of the glenoid width was a critical size.[21]

My interest was not just limited to the glenoid but also to the Hill-Sachs lesion (HSL) of the humeral head. The same-sized HSL can be stable or unstable depending on the size of the glenoid: even a small HSL could cause instability if it is accompanied by a large glenoid bone loss. I was surprised to find that all of the previous investigators focused on the size of HSL alone; none of them paid attention to the size of the glenoid at the same time. To clearly understand and estimate the risk of instability caused by the glenoid and the HSL, the glenoid track concept was introduced.[18,20] This concept was later expanded to the on-track/off-track concept[1,2] (**out-flows**).

Epilogue

As you see above, learning comes first. Next, the learned knowledge induces various why questions within yourself. You try various methods to find answers to your why questions. Eventually, you will be able to obtain a new finding out of your research. That is your product, your original creation. Because of these creations, we can step forward, 1 step at a time, in our understanding of shoulder function and pathophysiology. I would like to encourage the young doctors who are interested in shoulder surgery to learn first, ask why questions next, and find answers in the end. Learning is the first step of this very important process in your career. Then, asking questions and finding answers would follow. This is a cycle of creativity. Repeat this cycle again and again: learn, ask, and find!! Best wishes to all the young readers!!

Disclaimer

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