Atasoy Flap Fingertip Reconstruction: Long-term Patient-reported Outcomes in Male Laborers

Jacob D. Franke, BS*
Leighton T. Kraft, MD*
Brian A. Mailey, MD, FACS†

Background: Atasoy flaps (AFs) are commonly used to reconstruct digits after fingertip injuries. However, recent literature reports that some surgeons prefer skeletal shortening and closure, presumably because the procedure can be performed in the emergency department without the risk of flap-associated complications. The purpose of the present outcome study is to evaluate patient-reported, long-term satisfaction of AF reconstructions for fingertip injuries.

Methods: Adult, male patients working in manual labor occupations who underwent AF reconstruction for fingertip injuries were identified from an institutional database. Patients were administered an injury-specific questionnaire relating to nail growth, function, aesthetics, cryalgia, and hypersensitivity. They were then administered the QuickDASH questionnaire to report standardized functional impairment and asked about their overall satisfaction with their reconstructed finger.

Results: Twelve patients underwent AF fingertip reconstruction between 2015 and 2020. Eleven of these patients agreed to be interviewed, the majority having been treated in the emergency department setting. The overall satisfaction rate was 91% (n = 10). Common sequelae included hook nail 64% (n = 7), cold sensitivity 45% (n = 5), and hypersensitivity 27% (n = 3). There were no flap failures or tissue necrosis. One patient reported a second surgery for improvement of a hook nail deformity.

Conclusions: Long-term outcomes of AF reconstruction for fingertip injuries demonstrate high overall satisfaction. Patients appreciated tissue salvage to preserve digit length, even in those unconcerned with aesthetics. Issues reported by patients, such as cold intolerance, hook nail, and decreased tactile sensation, are similar to other treatment options for fingertip injuries. (Plast Reconstr Surg Glob Open 2022;10:e4599; doi: 10.1097/GOX.0000000000004599; Published online 28 November 2022.)

INTRODUCTION

Hand injuries account for 4.8 million visits to the emergency department each year, and traumatic injuries to the distal fingers are the most common hand injury. The majority of hand injuries occur in men, demonstrating a bimodal distribution with one peak between 15 and 40 years of age and another after 80 years of age. In the workplace, hand injuries comprise one-third of all occupational injuries with men accounting for three-fourths. Many of these individuals are employed in manual labor trades, making injuries of the hand particularly debilitating. Overall, hand injuries are responsible for 25% of the lost working time and 20% of permanent disability.

Fingertip pulp amputations are primarily caused by lacerations or crush injuries. Replantation of isolated severed fingertip pulp is challenging and less commonly performed in the United States. Treatment goals for restoring the fingertip pad include preservation of digit length, discernable sensation, and durable coverage for everyday use. Additional considerations include minimizing recovery time and creating a satisfying cosmetic appearance. Management options for these injuries include a variety of operative and nonoperative interventions.

The Atasoy flap (AF) is a volar V-Y advancement flap commonly used for patients desiring preservation of digital length. This flap was first described in 1935 by Tranquilli-Lea et al and reported in the United States by Atasoy et al in 1970. These volar pad flaps are particularly effective at covering dorsal oblique and transverse injuries. This triangular flap is created at the amputation
site with the base toward the wound and apex extending to the distal interphalangeal (DIP) joint (Fig. 1). The flap is mobilized and advanced to cover the soft-tissue deficits created by the amputation. Besides local flap reconstructions, skeletal-shortening procedures and conservative management can be used in the treatment of fingertip injuries.

Fingertip reconstructions are often thought to be complex procedures that require time in the operating room. As such, revision amputations are frequently preferred by some surgeons, because they are simple and can be performed in the emergency department. A recent survey by Miller et al reported that hand surgeons in practice for less than 5 years favored skeletal shortening and closure for several clinical scenarios of fingertip injuries compared with surgeons in practice longer. Another possible explanation for surgeons preferring revision amputations is healing time. A systematic review found that revision amputations can achieve almost normal sensibility and satisfactory motion on average with a return-to-work time of 47 days. AF reconstructions can also be performed in the emergency room without compromising tissue viability. The purpose of the present outcomes study was to evaluate patient satisfaction of male laborers who underwent fingertip reconstruction with AF. Patients completed a telephone interview reviewing the Quick Disabilities of the Arm, Shoulder, and Hand (QuickDASH) questionnaire along with additional fingertip-related questions to determine their level of disability, pain, and function. Our hypothesis is that the AF reconstruction will be associated with high overall patient satisfaction and low rates of complication and secondary surgery.

METHODS

Patients

All patients who underwent AF fingertip reconstruction between 2015 and 2020 by a single surgeon were interviewed. The long-term outcomes of Atasoy flap reconstruction for these fingertip injuries demonstrated high overall satisfaction. Issues reported by patients such as cold intolerance, hook nail, and decreased tactile sensation are similar to other treatment options for fingertip injuries. Our hypothesis is that the AF reconstruction will be associated with high overall patient satisfaction and low rates of complication and secondary surgery.

Takeaways

**Question:** What are the long-term, patient-reported outcomes of fingertip injuries reconstructed with Atasoy flaps?

**Findings:** We retrospectively interviewed male laborers who underwent Atasoy flap fingertip reconstruction. The long-term outcomes of Atasoy flap reconstruction for these fingertip injuries demonstrated high overall satisfaction. Issues reported by patients such as cold intolerance, hook nail, and decreased tactile sensation are similar to other treatment options for fingertip injuries.

**Meaning:** Atasoy flap fingertip reconstructions result in high patient satisfaction and are safe to perform in the emergency room setting with few flap-associated complications.

**Fig. 1.** A 20-year-old male patient with a fingertip injury of the long finger of his right hand. A, This transverse Allen 2 defect was reconstructed with an AF. B, The outline of the triangular flap is drawn with the base toward the amputation site and the apex extending to the DIP joint. C, The flap is mobilized, advanced, and inset over the defect suturing the flap to the nailbed and nail plate. D, Sagittal view of flap inset demonstrating the base of the flap sutured to the nailbed. E, Long-term follow-up of healed flap demonstrating hyponychial support for the growing nail.
identified via an institutional database. Only adult, male patients employed in manual labor occupations who sustained isolated fingertip injuries were eligible for inclusion in the study. Patients with multiple finger or additional hand injuries were not included. Eligible patients were identified, contacted, and interviewed over the phone after obtaining verbal willingness to participate. Demographic and treatment data were collected from the electronic medical record. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008. A nonhuman subject research determination was submitted, and the local ethics committee, Springfield Committee for Research Involving Human Subjects, determined that this outcomes study (IRB Number 21-892) did not fall under the purview of the IRB as research involving human subjects according to 45 CFR 46.101 and 45 CFR 46.102.

**Surgical Technique**

The fingertip injury is thoroughly washed and debrided. A fingertip tourniquet is placed at the base of the proximal phalanx. Uneven bony fragments are trimmed, and the nailbed is cut in an even transverse direction. The AF is designed, and markings are made to preserve the proximal phalanx. Uneven bony fragments are trimmed, debrided. A fingertip tourniquet is placed at the base of the DIP joint but can be taken to the proximal interphalangeal (PIP) joint. After the skin incision, vertical septae are each individually cut, and the flap checked after each release to evaluate the tissues tethering the flap. Any tissue containing vascular or nervous tissue is preserved. Once the flap is able to be advanced to cover the defect, the majority, 64%, of injured digits were the long (n = 4) fingers (n = 3). Thirty-six percent of patients (n = 4) felt sensation similar to their other fingers, while 82% (n = 9) reported decreased sensation. Cold intolerance occurred in 45% of fingers (n = 5) and hypersensitivity in 27% of fingers (n = 3). Thirty-six percent of patients (n = 4) felt.

**RESULTS**

**Patients**

Twelve consecutive patients who underwent AF fingertip reconstruction between 2015 and 2020 were identified. Eleven patients agreed to participate in the project, as one was unable to be reached. All patients were men and working in a variety of occupations requiring manual labor: mechanic, machinist, lawn-care, city water department, carpenter, electrician, and butcher. Eighty-two percent (n = 9) of the injuries were work-related. Sixty-four percent of injuries (n = 7) occurred on the left hand, and the majority, 64%, of injured digits were the long (n = 4) and ring (n = 3) fingers; the index and small fingers represented 18% of the injuries each (Table 1). None of the AF reconstructions had complications of necrosis, infection, or flap failure. The average time between injury and response to the questionnaire was 32.6 months with a range of 14–55 months.

**Questionnaires**

Of the 11 patients, 18% (n = 2) reported tactile sensation similar to their other fingers, while 82% (n = 9) reported decreased sensation. Cold intolerance occurred in 45% of fingers (n = 5) and hypersensitivity in 27% of fingers (n = 3). Thirty-six percent of patients (n = 4) felt.

**Table 1. Demographic Information of the Patient Cohort**

| Patient | Gender | Age at Injury (y) | Hand, Digit | Occupation          | Time Since Injury (mo) | Work-related Injury |
|---------|--------|------------------|-------------|---------------------|------------------------|--------------------|
| 1       | Male   | 20               | Right, third| Butcher             | 55                     | Yes                |
| 2       | Male   | 65               | Right, second| Mechanic           | 45                     | No                 |
| 3       | Male   | 24               | Left, third | Meter reader        | 40                     | Yes                |
| 4       | Male   | 26               | Right, third| Precision drilling | 14                     | Yes                |
| 5       | Male   | 65               | Left, third | Electrician         | 36                     | Yes                |
| 6       | Male   | 65               | Left, third | Carpenter           | 19                     | Yes                |
| 7       | Male   | 48               | Left, fourth| City water department| 17                    | Yes                |
| 8       | Male   | 31               | Left, second| Lawn-care           | 28                     | Yes                |
| 9       | Male   | 56               | Right, fifth| Mechanic            | 34                     | No                 |
| 10      | Male   | 27               | Left, fifth | Machinist           | 20                     | Yes                |
| 11      | Male   | 32               | Left, fourth| Carpenter           | 51                     | Yes                |
| Summary |        | 39.2             | Right 36.4% and left 63.6% |                | 32.6 mo               | 81.8%              |
their finger limited them in their usual daily activities, which included playing guitar, working as a mechanic, and using hand tools. Patients found decreased digit sensation and hooked nail deformities to be the most troublesome aspects of their reconstruction. One patient reported feeling self-conscious about the appearance of their finger, and the same patient reported that other people notice their finger most of the time (Table 2). However, the remainder of the patients were not bothered by the appearance.

Overall, 10 out of the 11 patients reported being satisfied with the results of their finger. Furthermore, 91% (n = 10) of patients would have the same procedure again, but one patient preferred to have a bone-shortening procedure over an AF reconstruction if given the choice. Nine percent (n = 1) of patients reported having an additional surgery on the finger to correct a hook nail deformity with a nailbed ablation. Overall, 64% (n = 7) of patients reported having a hooked nail (Fig. 2). The mean QuickDASH disability and symptom score was 5.9 with a range between 0 and 25. Five patients had a score of 0, and the median score was 2.27. The work module mean score was 7.95 with a range of 0–50. The mean score for the sports and performing arts module was 6.14 with a range of 0–25.

**DISCUSSION**

Fingertip injuries can be treated in a variety of ways, and algorithms have been proposed to facilitate management.12 Although recent studies demonstrate that nonoperative treatment is an effective method, operative treatments are often preferred for larger soft-tissue defects or exposed bone.13 The aim of this study was to determine patient-reported, long-term satisfaction outcomes of AF reconstruction for fingertip injuries. Previous studies reported outcomes of AF reconstructions (Table 3) in heterogeneous populations, which included men, women, and children.14–17 Since men account for the majority of occupational hand injuries, our study evaluated AF reconstruction outcomes of male laborers. Our results demonstrated that AF reconstructions for fingertip injuries have a high patient satisfaction rate in this population despite a few common pitfalls. All patients were treated by the same surgeon,

**Table 2. Patient-reported Outcomes of Fingertip Reconstruction with AF**

| Patient | Infection | Flap Failure | Quick-DASH Work | Quick-DASH SPORT | Add. Surgery | Sensation (Normal or Decreased) | Hook Nail | Cold Sensitivity | Hyper-sensitivity | Range of Motion | Satisfied with Result | Self-conscious of Digit Appearance |
|---------|-----------|--------------|-----------------|-----------------|-------------|-------------------------------|-----------|-----------------|-----------------|----------------|----------------------|----------------------------------|
| 1       | No        | No           | 0               | 0               | No          | Decreased                     | No        | No              | No              | Normal         | Yes                  | No                               |
| 2       | No        | No           | 25              | 25              | No          | Decreased                     | Yes       | No              | No              | Decreased      | Yes                  | No                               |
| 3       | No        | No           | 6.81            | 0               | No          | Decreased                     | No        | No              | No              | Normal         | Yes                  | No                               |
| 4       | No        | No           | 8.1             | 0               | No          | Decreased                     | No        | No              | No              | Normal         | Yes                  | No                               |
| 5       | No        | No           | 6.81            | 0               | No          | Decreased                     | Yes       | No              | No              | Normal         | Yes                  | No                               |
| 6       | No        | No           | 4.54            | 0               | No          | Decreased                     | No        | No              | Yes             | Normal         | Yes                  | No                               |
| 7       | No        | No           | 12.5            | 0               | No          | Decreased                     | Yes       | No              | Yes             | Normal         | Yes                  | No                               |
| 8       | No        | No           | 15.9            | 0               | No          | Decreased                     | Yes       | Yes             | Decreased       | No              | No                   | No                               |
| 9       | No        | No           | 15.9            | 0               | No          | Decreased                     | Yes       | Yes             | No              | Normal         | Yes                  | No                               |
| 10      | No        | No           | 0               | 0               | No          | Normal                        | No        | No              | No              | Normal         | Yes                  | No                               |
| 11      | No        | No           | n/a             | 50              | 5           | Decreased                     | Yes       | No              | Yes             | Normal         | Yes                  | Yes                              |
| Averages| 0         | 0            | 5.9             | 7.95            | 6.14        | 9.1                           | 81.8      | 63.6            | 45.4            | 27.3           | 18.2                 | 90.9                            | 9.1

*The additional surgery was for hook nail treatment.

**Fig. 2.** A 26-year-old man with a hook nail deformity in the third digit following fingertip reconstruction with an AF. He is the only patient in our series who went on to have a secondary surgery for nailbed ablation. A, Dorsal view. B, Palmar view. C, Split-thickness skin graft after nail ablation procedure.
and most reconstructions were performed in the emergency room setting. Over 90% of the patients were satisfied with the results of their digit repair, and the vast majority expressed appreciation for having preserved digit length. We believe that high satisfaction with AF reconstruction can in part be attributed to the absence of flap complications and the preservation of relative anatomic normalcy with a preserved nail plate and fingertip. Our patients had a low need for additional surgery, with only one worker-compensation patient requesting an additional surgery for treatment of his hook nail deformity. One patient was dissatisfied and would have elected to undergo a bone-shortening procedure instead of AF if given the option again. During the interview, he reported hypersensitivity, cold sensitivity, and a hook nail deformity. He also complained of a decreased range of motion, and PIP joint flexion contracture was noted at follow-up, which may have occurred regardless of fingertip treatment and contributed to his dissatisfaction. This patient had a volar oblique injury to the tip of the right, small finger (Fig. 3). Of note, this was the only volar oblique fingertip injury, as the other amputations were transverse or dorsal oblique (Fig. 4). Viciana and Lessard et al. reported that AF reconstructions can be used to cover modest volar oblique amputations in a single stage. However, long-term outcomes of AF reconstructions for volar oblique injuries are unknown.

Table 3. Studies Evaluating Long-term Outcomes of AF Reconstruction

| Authors          | Year | No. Patients with AF Reconstruction (at Follow-up versus Total) | Patient Demographics | Average Follow-up Time | Reported Outcomes                                                                 |
|------------------|------|---------------------------------------------------------------|----------------------|------------------------|-----------------------------------------------------------------------------------|
| Weston and Wallace 14 | 1976 | 7/7                                                          | Male:Female:Not specified:Not specified:Not specified | 2-63 y*:2.6 y* | Four out of seven patients reported “good results”                                    |
| Frandsen 15       | 1978 | 10/12                                                         |                       |                        | Average time of healing time: 21 d Average missed work time: 29 d               |
|                   |      |                                                               |                       |                        | Paresthesia: 10%                    Coldness: 40%                             |
|                   |      |                                                               |                       |                        | Tenderness on percussion: 40% Coldness: 40%                                      |
|                   |      |                                                               |                       |                        | Difficulty grasping small objects: 50% Satisfied: 75%                            |
|                   |      |                                                               |                       |                        | Dissatisfied: 12.5%                   Noncommittal: 12.5%                        |
|                   |      |                                                               |                       |                        | Patient sensation estimate: 73% Hook nail deformity: 50%                        |
|                   |      |                                                               |                       |                        | Good epicritical tactile sensitivity: 67% Hyponychial scarring: 73% Normal pulp shape: 43% |

*For entire cohort of patients with fingertip reconstructions, not only AF reconstructions.

Fig. 3. A 56-year-old man with large volar oblique fingertip injury underwent AF reconstruction. A, Right small finger injury prior to reconstruction. B, Two weeks after AF reconstruction. This patient reported limited range of motion and flexion contracture of the PIP joint. He represents the only patient in our series dissatisfied with his outcome.

Fig. 4. A 32-year-old man with transverse injury to the left ring finger with additional proximal laceration. A, Dorsal view of injury. B, Palmar view of injury demonstrating the additional laceration through the tissue used to create the AF. C, Dorsal view of long-term fingertip reconstruction with successful AF.
The AF reconstruction has limitations. Hook nail deformities are common sequelae as the flap can fail to recreate the hyponychium and may pull the distal nailbed in the volar direction. Patients generally need to be diligent about nail hygiene. Sensation is also generally reduced compared with a normal digit. In our cohort, hook nail deformities, cold intolerance, and hypersensitivity were found to occur in 64%, 45%, and 27% of repaired fingers, respectively. However, these long-term issues are common in all fingertip treatment modalities. Van den Berg et al. found varying degrees of cold intolerance occurred in 82.6% of patients with bone-shortening procedures and in 90.9% of patients with conservative treatment. A hook nail deformity occurred in 30.4% and 63.3% of patients with bone-shortening procedures or conservative treatment, respectively. They found some degree of cold intolerance in 84% of patients and hook nail deformity in 56% of patients undergoing fingertip reconstruction, with V-Y advancement flaps accounting for nine of the 25 finger reconstructions. Haehnel et al. found similar long-term results in children with AF repair. A hook nail deformity was observed in 50% of patients, while cold sensitivity occurred in 40% of patients and pain sensitivity in 33%.

The majority of patients in our cohort, 82%, reported that tactile sensation was decreased compared with their other digits. Tupper and Miller reported that sensation had returned to near normal in all patients after 3 months. Disability was assessed by the QuickDASH questionnaire, and the mean score for the work module was 5.9 with five patients having a score of 0 indicating minimal disability overall. The mean scores for the work and sports-performing arts modules were 7.95 and 6.14, respectively. Similarly, Tupper and Miller reported that all the patients in their cohort returned to their premorbid occupation. However, Bot et al. measured disability in 70 patients with finger injuries distal to the PIP joint and found that the mean DASH score was 35 at the time of presentation and 17 one month later. Our cohort’s mean follow-up time was 32.6 months, which could explain our overall lower disability scores.

This review of AF reconstructions included a consecutive sample of male-laborer patients. The majority of these patients were satisfied with their reconstructive outcomes. We have found this to be generalizable to our patients with seemingly consistent sentiment. We excluded patients with multidigit injuries from this analysis but have also found a similar sentiment in these patients. Our findings may not be generalizable to different populations, as our cohort of Midwesterner laborers likely included patients least concerned with the aesthetic appearance of their hands. Despite this assumption, almost all patients in this study appreciated having the length of their digit, even though it required more routine nail manicuring. One hand surgeon performed all of these procedures and administered the questionnaires to the patients over the telephone; this may have influenced patient responses. Furthermore, the data generated from the questionnaires were subjective and retrospective at a single time point.

CONCLUSIONS

The AF for fingertip reconstruction leads to high patient satisfaction rates in male laborers. We found that male laborers appreciate maintaining full digit length, and these procedures can be performed efficiently in the emergency department. We recommend the V-Y flap as the primary reconstructive option for fingertip injuries in amenable patients. We believe that high satisfaction with AF reconstructions can in part be attributed to the absence of complications, the preservation of relative anatomic normalcy with a preserved nail plate and fingertip, and little need for secondary surgery. Common long-term problems are consistent with other treatment modalities for fingertip injuries and include cold sensitivity, hook nail, and decreased sensation of the affected finger.

Brian A. Mailey, MD, FACS
Associate Professor of Surgery
Division Chief of Plastic Surgery
Chief, Pediatric Plastic Surgery
Cardinal Glennon Children’s Hospital
St. Louis University School of Medicine
1008 S. Spring St., 1st Floor
St. Louis, MO 63110
E-mail: brian.a.mailey@gmail.com

REFERENCES

1. Sorock GS, Lombardi DA, Hauser RB, et al. Acute traumatic occupational hand injuries: type, location, and severity. J Occup Environ Med. 2002;44:345–351.
2. Eggermann K, Gess B, Häusler M, et al. Hereditary neuropathies. Dtsch Arztebl Int. 2018;115:91–97.
3. Marty J, Porcher B, Autissier R. [Hand injuries and occupational accidents. Statistics and prevention]. Ann Chir Main. 1983;2:368–370.
4. Sindhu K, DeFroda SF, Harris AP, et al. Management of partial fingertip amputation in adults: operative and non operative treatment. Injury. 2017;48:2643–2649.
5. Germann G, Rudolf KD, Levin SL, et al. Fingertip and thumb tip wounds: changing algorithms for sensation, aesthetics, and function. J Hand Surg Am. 2017;42:274–284.
6. Peterson SL, Peterson EL, Wheatley MJ. Management of fingertip amputations. J Hand Surg Am. 2014;39:2093–2101.
7. I. TF. Ricostruzione dell’apice delle falangi ungueali mediante autoplastica volare peduncolata per scorrimento. Inf Portfolio. 1970;52:921–926.
8. Atasoy E, Ioakimidis E, Kasdan ML, et al. Reconstruction of the amputated finger tip with a triangular volar flap. A new surgical procedure. J Bone Joint Surg Am. 1970;52:921–926.
9. Miller AJ, Rivlin M, Kirkpatrick W, et al. Fingertip amputation treatment: a survey study. J Am Orthop Assoc. 2013;15:331–339. Available at https://www.mdedge.com/surgery/article/102980/hand-wrist/fingertip-amputation-treatment-survey-study.
10. Wang K, Sears ED, Shauver MJ, et al. A systematic review of outcomes of revision amputation treatment for fingertip amputations. Hand (N Y). 2013;8:139–145.
11. Wilson CD, Parsons MS, Kallina CFV, et al. V-Y advancement flaps belong in the orthopaedic resident’s emergency department armamentarium: a case report of two patients. Current Orthopaedic Practice. 2021;32:102–106.
12. Lemmon JA, Janis JE, Rohrich RJ. Soft-tissue injuries of the fingertip: methods of evaluation and treatment. An algorithmic approach. *Plast Reconstr Surg.* 2008;122:105e–117e.
13. Weichman KE, Wilson SC, Samra F, et al. Treatment and outcomes of fingertip injuries at a large metropolitan public hospital. *Plast Reconstr Surg.* 2013;131:107–112.
14. Weston PAM, Wallace WA. The use of locally based triangular skin flaps for the repair of finger tip injuries. *The Hand.* 1976;8:54–58.
15. Frandsen PA. V-Y plasty as treatment of finger tip amputations. *Acta Orthop Scand.* 1978;49:255–259.
16. Tupper J, Miller G. Sensitivity following volar V-Y plasty for fingertip amputations. *J Hand Surg Br.* 1985;10:183–184.
17. Haehnel O, Plançq MC, Deroussen F, et al. Long-term outcomes of atasoy flap in children with distal finger trauma. *J Hand Surg Am.* 2019;44:1097.e1091–1097.e1096.
18. Viciana EJ, Lessard AS. Expanded utilization of the digital atasoy flap. *Plast Reconstr Surg Glob Open.* 2018;6:e2049.
19. van den Berg WB, Vergeert RA, van der Sluis CK, et al. Comparison of three types of treatment modalities on the outcome of fingertip injuries. *J Trauma Acute Care Surg.* 2012;72:1681–1687.
20. Krishnan KG. Sensory recovery after reconstruction of defects of long fingertips using the pedicled V flap. *Br J Plast Surg.* 2001;54:523–527.
21. Bot AGJ, Bossen JK, Mudgal CS, et al. Determinants of disability after fingertip injuries. *Psychosomatics.* 2014;55:372–380.