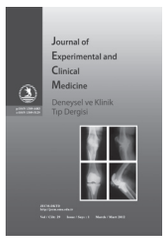
Journal of Experimental and Clinical Medicine
Deneysel ve Klinik Tıp Dergisi



Clinical Research **doi:** 10.5835/jecm.omu.29.01.001

Hipokrat 2000 total knee arthroplasty in gonarthrosis: midterm follow-up results

Yılmaz Sahin*[a], Birol Gulman[b], N.Turgut Karaismailoglu[b], Nevzat Dabak[b], Yılmaz Tomak[b], Ahmet Piskin[b], Murat Erdogan[b]

[a] *Medicana International Samsun Hospital, Orthopedics and Traumatology Clinics, Samsun, Turkey*
[b] *Department of Orthopedics and Traumatology, Medical Faculty, Ondokuz Mayis University, Samsun, Turkey*

ARTICLE INFO

Article History
Received 06 / 11 / 2011
Accepted 28 / 12 / 2011

*** Correspondence to**
Yılmaz Sahin
Medicana International
Samsun Hospital,
Orthopedics and Traumatology
Clinic,
Samsun, Turkey
e-mail: yilmazfsahin@hotmail.com

Keywords:
Gonarthrosis
Knee
Knee prothesis
Total knee arthroplasty

ABSTRACT

The aim of this study is to assess the mid-term results of Hipokrat 2000 total knee arthroplasty applications in gonarthrosis cases. Between February 2000 and January 2004 in Department of Orthopedics, Medical Faculty, Ondokuz Mayıs University, Hipokrat 2000 total knee arthroplasty was applied to 68 knees (31 right, 37 left) of total 54 patients (49 female, 5 male) with the diagnosis of gonarthrosis. The average age of the patients at the time of surgery was 63.5 (distribution 49-80). Etiological reason was determined to be primary osteoarthritis in 49 patients and rheumatoid arthritis in 5 patients. Patellar component was used in 63 of the cases. The cases were assessed before and after the surgery in accordance with clinical and radiological evaluation and scoring system of the Knee Society. The average follow-up period was 52.6 months (distribution 28-76 months). In accordance with clinical evaluation system of the Knee Society, in 61 of the 68 knees (89.7%) the result was good or excellent, in 5 patients (7.3%) the result was fair, in 2 patients (2.9%) the result was poor. An increase of average 56.7 degrees in knee scores and average 52.1 degrees in function scores was detected. Average 37.5 degrees of increase was detected in the range of movement in comparison to pre-operation. The average alignment angle in the knees was found to be 4.68 degrees valgus. As complications; in one patient patellar subluxation, in one patient superficial infection, in one patient deep infection and in one patient deep vein thrombosis were seen. When studies carried out with other semi constrained, posterior cruciate ligament retaining surface replacement prosthesis brands in literature were reviewed; the fact that the clinical and radiological results of Hipokrat 2000 total knee arthroplasty are good shows that it is an appropriate prosthesis for advanced gonarthrosis cases.
J. Exp. Clin. Med., 2012; 29:1-5

1. Introduction

As the when average human life expectancy is increasing, gonarthrosis appears to be a restricting disease which decreases life quality. Anti-inflammatory drugs and physical therapy methods and surgical treatment methods such as synoviectomy, high tibial osteotomy or femoral osteotomy are most of the times insufficient for the treatment of advanced cases. Total knee arthroplasty (TKA) is a good alternative for these patients. The aim is to have a painless, moving and stable knee joint by replacing the joint surfaces that are wrecked and whose repair capacity is very low. As a result of the process that emerged with Vernevil putting forward the idea of treatment with placing an external substance between two surfaces in 1869 (Insall, 1984; Tooms, 1992). With Campbell and Boyd using the first vitallium prosthesis Tooms, (1992) and Gunstone, (1971) using metal-plastic knee prosthesis since 1969, TKA started to be an effective alternative in gonarthrosis treatment (Gunstone, 1971; Insall et al., 1986; Hungerford et al., 1989). Although Gunston's polycentric prosthesis was the first cement surface replacement prosthesis, (Gunstone, 1971) the studies of Freeman and Swanson in 1973 established the basic principles for both prosthesis design and the surgical technique to be applied (Insall, 1993). With the improvements in bio-mechanic technology in the last 30 years and the changes in implant design, surgical technique and instrumentation the results of TKA have started to be more positive (Ritter et al., 1985). Due to the fact that this operation which improves life quality by providing obvious benefits to the patient is widely used in our country in the last 15-20 years, the need to assess the results and discuss them by comparing with other studies has arose. Hipokrat 2000 knee prostheses are semi constrained, posterior cruciate ligament retaining surface replacement prosthesis designs.

In this study, midterm results of gonarthrosis cases where Hipokrat 2000 total knee arthroplasty is applied in our clinic are presented and discussed.

2. Materials and methods

In Ondokuz Mayıs University, Medical Faculty, Orthopedics and Traumatology Clinic, between February 2000 and January 2004, posterior cruciate ligament retaining, semi constrained cement Hipokrat 2000 TKA was applied to total 68 knees (17 right, 23 left, 14 bilateral) of 54 patients, 49 (90.7%) of which were female, 5 (9.3%) of which were male, and the cases were assessed retrospectively. As primary pathology, it was detected that 49 (90.7%) of the patients had degenerative arthritis and 5 (9.3%) of them had rheumatoid arthritis. Average age of the patients was 63.5 (ages 49-80).

The decision of replacing the patella was given according to the condition of the cartilage surface that was seen in the surgery, and it was replaced if the patella joint surface was advanced degenerative and the subchondral bone was fully exposed. For the patients who were not put a patellar component, the osteophytes on the patella were resected during surgery, and denervation was carried out with peripatellar cauterization. Pneumatic tourniquet was used during the surgery. For all of the operated knees, midline longitudinal incision through skin and subcutaneous and medial parapatellar arthrotomy was made. In order to shorten the operation time for the cases where bilateral application is done in the same session, when one knee was being closed, surgical operation started on the other one by wrapping a sterile Esmarch bandage around it and tightening the tourniquet. Eight hours and one hour before the surgery, intravenous cefazolin sodium was given to the patients as a parenteral prophylactic and continued to be given in 8 hour intervals until the drain was pulled (infection prophylaxis was applied). For the prophylaxis of thromboembolic complications, the dose of low molecular weight heparin was calculated according to the body weight of the patient and was started and continued up to 10 days after the surgery.

After the drains of the patients were pulled within 48 hours, isometric quadriceps stretching exercises and passive and active ROM exercises with CPM (Continue Passive Motion) machine were started. From the second day, first passive then active assisted flexion and extension exercises were carried out. After the surgery, usually starting from the third day, the patients stood up with the help of a walker. The patients continued their rehabilitation programs at home and were followed in the 1st, 2nd, 3rd, 6th and 12th months after the surgery and once a year, an average of 52.6 months (28-76 months). The last controls were done in August 2006.

The patients were scored and assessed using the pre-operative and post-operative clinical and radiological Knee Society Arthroplasty Evaluation Form (Ewald, 1989; Insall et al., 1989; Tözün, 1990; Tözün et al., 1990). Clinical evaluation was carried out over 100 points in two separate categories as knee score and functional score. In the evaluation of the knee score, the pain of the patient, range of movement, stability of the knee, existence of flexion contracture, extension loss and tibiofemoral compatibility were considered. In the calculation of function score, walking distance, ability to climb stairs and the need to use a helping device was considered. According to this scoring system 85-100 points are considered to be excellent, 70-84 points are good, 60-69 points are fair, 59 points and less are poor (failure).

Radiological evaluation was carried out with the help of standard anterioposterior (AP) and lateral graphy, tangential graphy and orthoroentgenography that is used for mechanical and anatomical axle measurement. The radiolucent lines in the bone–cement interval were assessed in accordance with the zones defined by the Knee Society (Ewald, 1989). According to this evaluation radiolucent zones; 4 mm or less not significant, 5-9 mm should be followed for progressive loosening, 10 mm or greater signifies possible or impending failure regardless of symptoms.

Patellar component was used for 63 of the patients who underwent TKA. After prosthesis implantation was done, for the patients who did not have patellofemoral compatibility, lateral retinaculer release was performed. While carrying out this procedure, it was cared not to disturb the blood circulation in the patella. General anesthesia was applied on 9 of the patients, spinal anesthesia was applied on 32 and spinal-epidural combined anesthesia was applied on 13. Average hospitalization period was 14 days.

Statistically, before and after the surgery, knee and function scores and flexion degrees were compared as regards to the Wilcoxon Signed Ranks test.

3. Results

In accordance with the clinical evaluation system of the Knee Society, while in the pre-operative period 57 (83.8%) of the 68 knees were poor, 11 (16.1%) were fair, in the post-operative period the results were as follows: 61 (89.7%) of 68 knees were good or excellent, 5 (7.3%) were fair, 2 (2.9%) were poor. In our pre-operative knee score evaluation carried out in accordance with the Knee Society criteria, the average point was 32.2 (5-45), whereas in our post-operative evaluation the average point was 88.9 (77-100).

In the pre-operative period whereas flexion contracture did not exist in 38 (55.8%) knees, in 19 (27.9%) knees 5-10 degrees, in 11 (16.1%) knees 10-20 degrees of flexion contracture existed. In the post-operative period, while flexion contracture was not seen in 54 (79.4%) knees, in 12 (17.6%) knees 5-10 degrees, in 2 (2.9%) knees 10-20 degrees of flexion contracture was seen. While in the pre-operative period medium and high level of pain was expressed for all knees, in the post-operative period no pain or slight or rare pain was expressed in 58 (85.2%) knees. For 6 (8.8%) knees only when climbing the stairs, for 1 (1.4%) knee walking and stair climbing, for 2 (2.9%) knees medium level rare and for 1 (1.4%) knee medium level constant pain was expressed. Whereas the movement limit was average 68.3 degrees (40-90) in the pre-operative period, in the post-operative period it increased 37.5 degrees and was found to be 105.8 (80-150) degrees. For all of the knees in the series an increase in flexion was seen in comparison to pre-operation period. When the function scores of the cases were assessed, it was seen in the post-operative last check that the function score, which was average 38.5 points (15-70 points) in pre-operative period, increased 47.1 degrees and became average 85.6 points (50-100 points). In accordance with the clinical evaluation system of the Knee Society, the results were as follows; 61 (89.7%) of 68 knees were good or excellent, 5 (7.3%) were fair, 2 (2.9%) were poor. In the statistical analysis that was carried out using the Wilcoxon Signed Ranks test, a significant difference was detected in pre-operation and post-operation periods as regards the Knee Society knee scores ($p<0.05$), function scores ($p<0.05$) and flexion degrees ($p<0.05$).

Whereas in pre-operative period in 57 (83.8%) knees average 6.76 degrees (2-16) varus, in 3 (4.4%) knees neutral angle and in 8 (11.7%) knees average 5.25 degrees (2-12) valgus was seen, in the post-operative period in 6 (8.8%) knees average 4 degrees (2-6) varus, in 8 (11.7%) knees neutral angle, and in 54 (79.4%) knees average 6.34 degrees (1-9) valgus was seen. Pre-operative average alignment angle of 4.97 varus was seen to be 4.68 valgus post-operative.

In the AP graphies average femoral flexion angle was detected to be (α) 96.2 degrees (90-102) and average tibial angle was detected to be (β) 89.9 degrees (82-90). In lateral graphies average femoral flexion angle is detected to be (γ) 2.8 degrees (1-8), and average tibial angle was detected to be (δ) 88.1 degrees (78-90).

When radiolucent lines were examined as regards to prosthesis loosening, in 49 (90.1%) knees no radiolucent lines were seen. In 18 (26.4%) knees less than 4 mm, in 1 (1.8%) knee 5-9 mm of radiolucent line was seen. No changes were detected in the alignment or the position of the prostheses. In one patient superficial and in one patient deep infection was seen.

Patellar prosthesis was not used in 5 of the 68 knees that underwent tangential graph. Patellar subluxation was seen in 1 of the 63 knees where prosthesis was put.

4. Discussion

Total knee arthroplasty is a successful treatment method; when patients feel strong pain that wakes them from their sleep, in existence of deformity and movement constraint, in advanced gonarthrosis cases, where no other option is left, provided that the indications are met. The most important reasons of deciding whether to operate on the patients who were included in the study are, aside from the radiological findings, the strong pain which happens during resting, wakes them up from their sleep and does not heal with drugs and physical therapy, and difficulty in stair climbing and movement constraint. Insisting on drug treatment and unreasonably delaying the surgery may have a negative effect on the functional level of the patient after TKA. The clinical results of TKA that is performed when the functional capacity and muscle power of the patient is low are worse than the ones that are operated in an early stage. (Beksaç et al., 2006). A successful TKA should remove the pain and provide sufficient joint movement angle. Moreover, it should fix deformities and provide necessary stability and function for daily activities.

In literature, TKA is performed more frequently on patients over the age 50. There is no age limit for the patients with rheumatoid arthritis. The average age of the patients who underwent total knee arthroplasty in this study was 63.5 and the youngest patient was the one with RA at the age of 49. Just as in the other studies, the average age of the patients in our study group was over 50. In the assessments after the surgery when parameters such as age and etiology were reviewed, clinical evaluation score was found to be higher in patients with rheumatoid arthritis. Obvious differences in occurrence frequency were not detected in the two extremities.

The main aim in performing TKA is to maintain a painless, stable and functional joint (Hungerford and Krackow, 1985; Tooms, 1992). In this study, in the last checks 58 (85.2%) knees were found to have no or slight or rare pain.

There is not a full consensus in the literature about replacing the patellar surface as a routine. Whereas some writers argue that it should be replaced as a routine, another group suggests that patellar surface should be replaced as a routine only in rheumatoid arthritis since joint cartilage tissue is responsible for synovial reaction, and they argue that the situation is different in osteoarthrosis and in these cases the surface should be replaced if there is cartilage erosion and advanced deterioration on the joint surface. Moreover, there is higher complication risk related to patellar implantation (Soudry et al., 1986; Rand, 1994). Complication rate that is seen after the replacement of the patellar surface is between 1-30% and osteonecrosis, patellar fracture, malalignment, subluxation, loosening, component insufficiency could be counted among them (Merkow et al., 1985; Kayler and Lyttle, 1988). In our series patellar prosthesis was applied on 63 (92.6%) patients. Patellar subluxation was seen in one patient. Patella fracture was not seen in any patients. In one patient deep venous thrombosis which recovered clinically in an early stage was detected. In our day, many successful implant designs retaining, cutting or substituting the posterior cruciate ligament (PCL) are being used. Whether to retain the PCL or not is still being discussed. Whereas the ones who argue that PCL should be cut express that the surgical technique is easier and there is less polyethylene erosion due to more compatibility of joint surface, the ones who argue that PCL should be retained express that the posterior cruciate ligament hinders anterior and posterior shear strength, causes weakening in bone-cement surface, and help femoral roll-back on the tibia (Mihalko and Krackow, 1999; Kadoya et al., 2001). Dorr et al. (1988) detected an increase of medial joint load and occurring strengths in the knees where posterior cruciate ligament is not retained. Scott and Volatile, (1986) noted that function and resistance is higher in the knees where PCL is retained. It is expressed that the posterior cruciate ligament is important for the proprioceptive sense and sacrificing it will cause loosening in the prosthesis due to increased varus, flexion and load moments (Dorr et al., 1988; Malkani et al., 1995). It is shown that in the case when the posterior cruciate ligament is retained, tibiofemoral contact point will be more behind and quadriceps strength will increase and stair climbing will be easier (Andriacchi and Galante, 1982). Insall, (1986) and Ranawat, (1988) argued that the posterior cruciate ligament can be cut in order to fix the deformities in the knees where there are advanced flexion and varus deformity. When knee arthroplasties where posterior cruciate ligament is retained and sacrificed are compared as regards to knee score, functional score, range of knee movement and radiological changes, no significant precedence is found (Insall et al., 1986; Dorr et al., 1988). Hipokrat 2000 brand knee prosthesis that was used in this study is semi constrained, posterior cruciate ligament retaining surface replacement prosthesis designs.

There are different opinions about cemented and non-cemented applications (Gil and Mills, 1991; Scuderi and Insall, 1992). In all of our cases fixation of the components were done with bone cement. The reason of this was that it allowed early rehabilitation of our patients.

When we compare it with the literature, it is seen that average 88.9 points of post-operative knee score and 85.6 points of function score comply with the literature (Stern et al., 1990; Turanlı et al., 1995; Baktır et al., 1997; Erdemli et al., 1997). While post-operative range of movement changes

between 95-110 degrees in different resources, the average value we acquired is 105.9 degrees. 4.97 degrees of average varus deformity in the pre-oporetive period reached an average of 4.68 degrees of valgus. It is observed that the high rate of varus deformity in the patients comply with the literature. Laskin and Rieger (1989) showed that the patients with no deformity had higher scores in the post-operative period and no complications were detected in the follow-ups.

Table. 1 The comparison of Hipokrat 2000 knee prosthesis with the studies in the literature carried out with other semi constrained, posterior cruciate ligament retaining surface replacement prosthesis

Literature	Average follow-up period	Post-operative Knee score	Post-operative Function score	Post-operative Range of movement
Tümöz et al. (1999)	42 months	88	72	101.5 º
Mert et al. (1999)	5.4 years	84	72.7	96.2 º
Mirzanlı et al. (2000)	76 months	81	72.7	96.2 º
Rowley et al. (2001)	7 years	77	65	---------
Back et al. (2001)	5 years	89	79	92-105 º
Akgün et al. (2002)	4.5 years	89.28	88.22	109.48 º
Our study	52.6 months	88.9	85.6	105.8 º

In the literature it is noted that the primary post-TKA infection prevalence changes between 0.5-5% (Segawa et al., 1999; Akgun et al., 2002). The fact that in our study the average infection rate was 2.9% with one patient (1.4%) having superficial infection and one patient having (1.4%) deep infection is found to comply with the literature. A 2 stage revision arthroplasty was suggested to the patient with deep infection however the patient did not accept since he/she did not suffer highly clinically. Complication risk after total knee arthroplasty surgery is between 1-16% and the complication rate in our study is found to be 5.8% (Rand and Fitzgerald, 1989).

There are many factors affecting the result of total knee arthroplasty. Appropriate indication, appropriate choice of patients, sufficient surgical technique, appropriate choice of prosthesis and post-operative rehabilitation play an important role in success (Akgun et al., 2002).

When the results of our study is compared with the studies carried out with other semi constrained, posterior cruciate ligament retaining surface replacement prosthesis brands in literature it is found to be compliant. Easy application and good clinical and radiological results of Hipokrat 2000 TKA we have used show that it is a convenient prosthesis in advanced gonarthrosis cases where there is no other option of treatment.

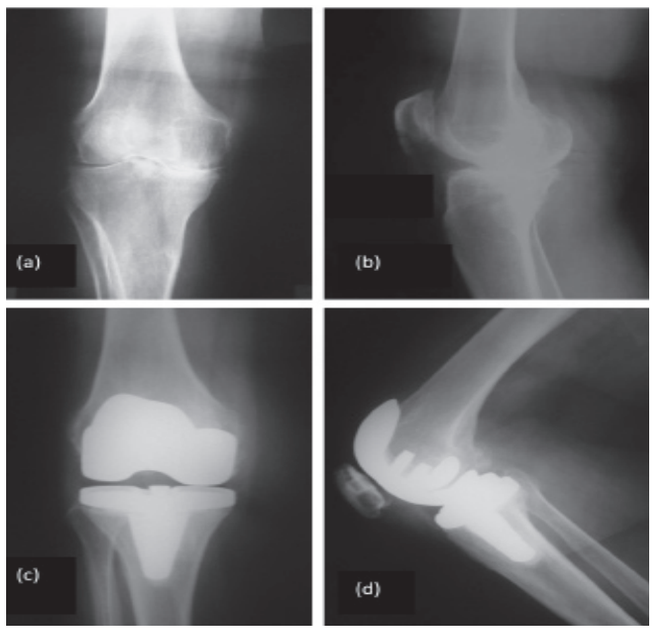


Fig. 1. Pre-operative (a) anterior/posterior and (b) lateral knee graphies of a case operated due to primary osteoarthritis; post-operative (c) anterior/posterior and (d) lateral knee graphies taken in the third year.

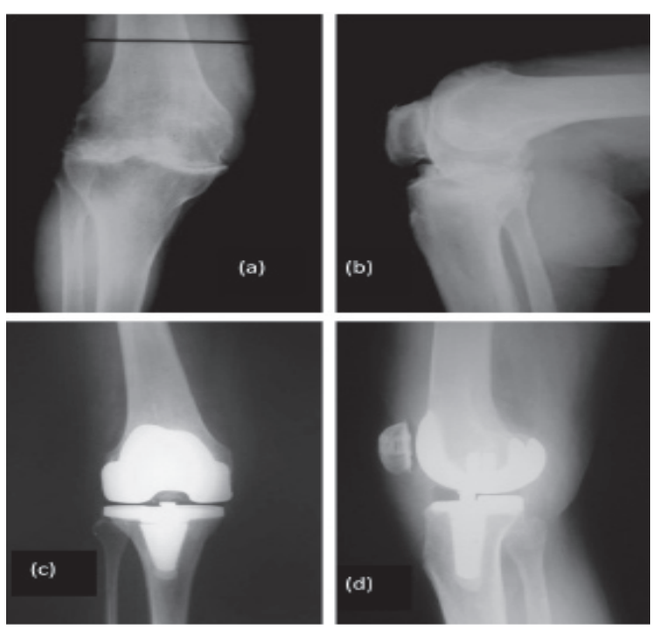


Fig. 2. Pre-operative (a) anterior/posterior and (b) lateral knee graphies of a case operated due to rheumatoid arthritis; post-operative (c) anterior/posterior and (d) lateral knee graphies taken in the fourth year.

REFERENCES

Akgun, I., Ogut, T., Kesmezacar, H., Yucel, I., 2002. Total diz artroplastisi: 4.5 yıllık takip sonuçlarımız. Acta Orthop. Traum. Turc. 36, 93-99.

Andriacchi, T.P., Galante, J.O., 1982. The influence of total knee replacement desings on function during walking and stair climbing. J. Bone Joint Surg. 64, 1328-1335.

Back, D.L., Cannon, S.R., Hilton, A., Bankes, M.J., Briggs T.W., 2001.The Kinemax total knee arthroplasty. Nine years experience. J. Bone Joint Surg. 83, 359-363.

Baktır, A., Kabak, Ş., Halıcı, M., 1997. Trikompartmantal sementli total diz artroplastisi sonuçlarımız. XV. Milli Türk Ortopedi ve Travmatoloji Kongre Kitabı. 727-730.

Beksaç, B., Şener, N., Tözün, İ.R., 2006. Gonartroz tedavisinde total diz artroplastisi. Türkiye Klinikleri Cerrahi Tıp Bilimleri Dergisi. Ortop. Travm. 2, 102-104.

Dorr, L.D., Ochsner, J.L., Gronley, J., Perry, J., 1988. Functional comparison of posterior cruciate retained versus cruciate sacrified total knee arthroplasty. Clin. Orthop. 236, 36-43.
Erdemli, B., Bayrakcı, K., Güzel, B., Çetin, İ., 1997. Total diz protezlerinde orta ve uzun dönem takiplerimiz. XV. Milli Türk Ortopedi ve Travmatoloji Kongre Kitabı. 744-747.
Ewald, F.C., 1989. The knee society total knee arthroplasty roentgenographic evalution and scoring system. Clin. Orthop. 248, 9-12.
Gil, G.S., Mills, D.N., 1991. Longterm followup evaluation of 1000 consecutive cemented total knee arthroplasties. Clin. Orthop. 273, 66-76.
Gunstone, H., 1971. Polycentric knee artroplasty, prosthetic simulation of normal knee movement. J. Bone Joint Surg. 2, 272-277.
Hungerford, D.S., Krackow, K.A., 1985. Total joint arthroplasty of the knee. Clin. Orthop. 192, 23-33.
Hungerford, D.S., Krackow, K.A., Kenna, R.V., 1989. Cementless total knee replacement in patients 50 years old and under. Orthop. Clin. North Am. 20, 131-145.
Insall, J.N., 1984. Total knee replacement. surgery of the knee. New York: Churchill Livingstone. 587-695.
Insall, J.N., Binnaji, R., Soudry, M., Mestriner, L.A., 1985. Total knee arthroplasty. Clin. Orthop. 192, 13-22.
Insall, J.N., Dorr, L.D., Scott, W.N., 1989. Rationale of the knee society clinical rating sysyem. Clin. Orthop. 248, 13-14.
Insall, J.N., 1993. Surgery of the knee. Churchill Livingstone, New York.
Kadoya, Y., Kobayashi, A., Komatsu, T., Nakagawa, S., Yamano, Y., 2001. Effects of posterior cruciate ligament resection on the tibiofemoral joint gap. Clin. Orthop. Relat. Res. 391, 210-217.
Kayler, D.E., Lyttle, D., 1988. Surgical interruption of patellar blood supply by total knee arthroplasty. Clin. Orthop. 229, 221-227.
Laskin, R.S., Rieger, M.A., 1989. The surgical technique for performing a total knee replacement arthroplasty. Orthop. Clin. North Am. 20, 31-48.
Malkani, A.L., Rand, J.A., Byron, R.S., Wallrichs, S.L., 1995. Total knee arthroplasty with the kinematic condylar prothesis. J. Bone Joint Surg. 77, 423-431.
Merkow, R.L., Soudry, M., Insall, J.N., 1985. Patellar dislocation following total knee replacement. J. Bone Joint Surg. 67, 1321-1327.
Mert, M., Caniklioğlu, M., Türel, Ş., Büyükgör, Ü.A., 1999. AGC total diz artroplastisi uygulaması ve geç takip sonuçlarımız. XVI. Milli Türk Ortopedi ve Travmatoloji Kongre Kitabı. 925-928.
Mirzanlı, C., Mert, M., Azar, N., Büyükgör, Ü.A., 2000. Kinematik kondiler AGC total diz artroplastisi: Orta dönem takip sonuçları. Acta Orthop. Traum. Turc. 34, 273-277.
Mihalko, W.M., Krackow, K.A., 1999. Posterior cruciate ligament effects on the flexion space in total knee arthroplasty. Clin. Orthop. Relat. Res. 360, 243-250.
Ranawat, C.S., Boachie-Adjei, O., 1988. Survivorship analysis and results of total condylar knee arthroplasty; eight to 11-year follow-up period. Clin. Orthop. 226, 6-13.
Rand, J.A., Fitzgerald, R.H., 1989. Diagnosis and management of the infected total knee arthroplasty. Orthop. Clin. North Am. 20, 201-210.
Rand, J.A., 1994. The patellofemoral joint in total knee arthroplasty. .J. Bone Joint Surg. 76, 612-620.
Ritter, M.A., Thomberry, R.L., Sliver, L.M., 1985. Total knee replacement and total hip arthroplasty: A comparison of result: Contemp. Orthop. 10, 73-77.
Rowley, D.I., McGurty, D.W., 2001. A seven-year experience of data collection on the Insall-Burstein II total knee arthroplasty. A prospective study. J. Bone Joint Surg. 83, 185-190.
Scott, R.D., Volatile, T.B., 1986. Twelve years experience posterior cruciate retained total knee arthroplasty. Clin. Orthop. 205, 100-107.
Scuderi, G.R., Insall, S.N., 1992. Total knee arthroplasty. Current clinical perspectives. Clin. Orthop. 276, 26-32.
Segawa, H., Tsukayama, D.T., Kyle, R.F., Becker, D.A., Gustilo, R.B., 1999. Infection after total knee arthroplasty. A retrospective study of the treatment of eighty-one infections. J. Bone Joint Surg. 81, 1434-1445.
Soudry, M., Mestriner, L.A., Binazzi, R., Insall, J.N., 1986. Total knee arthroplasty without patellar resurfacing. Clin. Orthop. 205, 166-170.
Stern, H., Bowen, M., Insall, J.N., Scuderi, G.R., 1990. Cemented total knee arthroplasty for gonarthrosis in patients 55 years or younger. Clin. Orthop. 260, 124-129.
Tooms, R.E., 1992. Artroplasty of ankle and knee. Campell's operative orthopaedics. Eighth edition. St. Louis: Mosby Year Book. 371-439.
Tözün, İ.R., 1990. Total diz endoprotezlerinde preoperatif hazırlık ve postoperatif değerlendirme. Acta Orthop. Traum. Turc. 24, 352-358.
Tözün, İ.R., Alparslan, M., Çetin, İ., Atik, Ş., 1990. Total diz endoprotezlerinin değerlendirilme ve puanlamasında hangi metod kullanılmalıdır? Acta Orthop. Traum. Turc. 24, 359-362.
Turanlı, S., Doğrul, H.T., Bozbeyoğlu, L., 1995. Total diz artroplastisi uygulamalarımız ve erken sonuçlar. Turkish journal of arthroplasty and arthroscopic Surg. 11, 15-18.
Tümöz, M.A., Köse, C.C., Seven, S., Nuhoğlu, N., 1999. Total diz protezi uygulamalarımızda erken takip sonuçları. XVI. Milli Türk Ortopedi ve Travmatoloji Kongre Kitabı. 918-921.